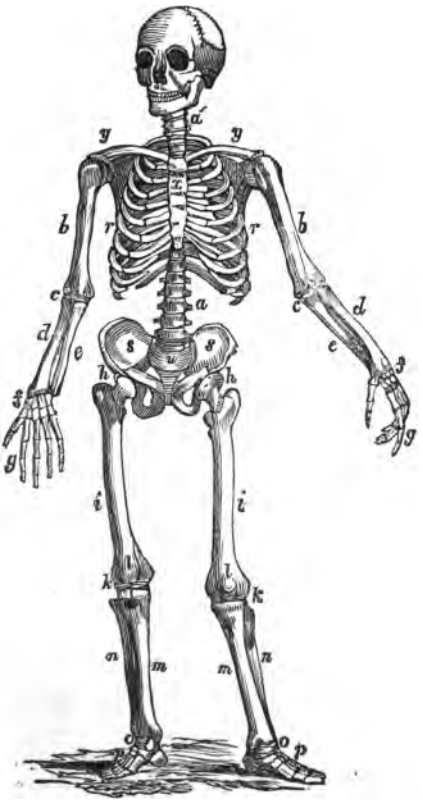
HUMAN ANATOMY SIMPLIFIED

BY

JOHN SIBREE.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HUMAN ANATOMY SIMPLIFIED;

IN A COURSE OF

Coventry:

PUBLISHED BY G. AND F. KING, FLEET STREET;

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1854.


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HUMAN ANATOMY SIMPLIFIED;

IN A COURSE OF

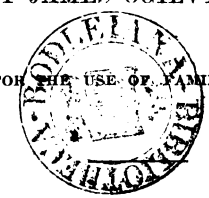
THREE ELEMENTARY LECTURES

ADDRESSED TO YOUTH OF BOTH SEXES;

BY JOHN SIBREE.

WITH A RECOMMENDATORY PREFACE

BY JAMES OGILVY, M.D.



DESIGNED FOR THE USE OF FAMILIES AND SCHOOLS.

ILLUSTRATED WITH ENGRAVINGS.

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ENTERED AT STATIONERS' HALL.

G. AND F. KING, PRINTERS, FLEET STREET, COVENTRY,

RECOMMENDATORY PREFACE,

BY JAMES OGILVY, M.D., EDIN.

CONSULTING PHYSICIAN TO THE COVENTRY PROVIDENT DISPENSARY.

THE thirst for scientific information on the part of all classes is a very gratifying feature of the present times: much has been done to meet this taste in various departments of useful knowledge: but it appears to me that, with reference to ANATOMY, a want still remains to be supplied.

The following Lectures are well calculated to afford much information on the structure and functions of the different organs of the human frame. They are written in a remarkably clear, comprehensive, and accurate style; and are, moreover, interspersed with many useful practical hints as to the care of the body. A considerable amount of instruction is conveyed in a small compass; and much credit is due to the Lecturer for the ability displayed in the compilation.

There is little doubt that,—were more attention paid to the study of the wonderful mechanism of the human frame; to the

unceasing action of the heart; to the constant flow of blood through all the different organs of the body; to the never-tiring movements of the lungs in breathing; to the intimate sympathy existing between every part of the system; and the danger to health and life from derangement of any of these structures,—much benefit would result, and the enjoyment of better health, and longer life, would be attained.

JAMES OGILVY.

Coventry, July, 1854.

AUTHOR'S PREFACE.

When the Author had closed the delivery of the following Lectures, he received applications from several of his youthful audience for recommendations of suitable books on the subjects which had been discussed. He well knew that the books required were such as should be small in size, elementary in character, simple in style, and low in price. The small and valuable "Catechism on Anatomy" in Pinnock's series, seemed to come the nearest to his views of what was wanted; but this treats the subject so generally and laconically, and employs so many technical terms, that it is more adapted to medical students, than to general readers.

Another ingenious and clever little volume, entitled "The House I Live in," is one that cannot fail to impart useful information on the structure and functions of the human frame. But some parts of even that interesting publication the Author considered as written in a style too scientific and abstruse for the class referred to. He therefore deemed that a small, cheap, elementary treatise on Anatomy was a desideratum; and this, by the earnest request of his auditors, he has endeavoured to supply: how far he has succeeded, he must leave to a candid and generous public to decide.

He is well aware that his not being of the medical profession, may be regarded by some as a disqualification for such a work as that which he has undertaken. He ventures, however, to suggest the opinion, that a non-professional man is in less danger of presuming on the amount of intelligence possessed by his readers, and is less liable to use technical terms, than those who are most at home in the science, and to whom such terms are

> "Familiar in their mouths as household words."

The aim of the Author has been to master the subject thoroughly himself, and so to accommodate his style that ordinary readers may have no difficulty in understanding it.

He trusts that his little book may be useful in affording some instruction to young persons in general, to families, to schools,

to Bible classes, and similar institutions; and he hopes that those who read it may rise from its perusal with a desire to know more.

It has been his constant and earnest desire and endeavour to direct the attention of his readers to the wisdom, the power, the goodness, and the mercy of God, so wonderfully displayed in the mechanism of the human frame: and happy will he be, if he should be successful in raising the thoughts, and in awakening the devout admiration of any towards "Him in whom we live, and move, and have our being;" for "It is He that hath made us, and not we ourselves."

The Author has occasionally touched upon the subject of Physiology; and has made a few remarks on Life, Health, and Disease in general; being fully aware that a mere detail and description of the several parts and functions of the human frame without such observations, would be like a Tree without leaves or fruit; a Skeleton without muscles or skin; or,—to borrow a figure from his own profession—an analysis of a Discourse without arguments or illustrations.

Those of his readers who heard the substance of the following Lectures delivered, will perceive that several alterations and additions have been made: these, he trusts, will be regarded as improvements.

It is more than probable, that if any Members of the Faculty should condescend to cast their eyes over the following pages, they may dispute some of the statements made: the Author, however, has not ventured to assert anything for which he could not quote high professional authority; but, alas!

"Who shall decide when *Doctors* disagree?"

He begs to add, that the following Lectures were succeeded by three on "Mental Philosophy; or, the Faculties and Exercises of the Human Mind;" which, if he meet with encouragement from the public, he may also send out from the press, uniform with the present Course, under the title of "Mental Philosophy Simplified."

Clifton Villa,
near Coventry, July, 1854.

CONTENTS.

HUMAN ANATOMY SIMPLIFIED.

FIRST LECTURE.

HUMAN ANATOMY is the subject of the present course of Lectures. These Lectures will be strictly elementary. I do not propose nor profess to treat the subject scientifically; but in a plain, simple, popular style; avoiding, as far as possible, all learned, technical terms and phrases.

I have been induced to take up the topics of Human Anatomy and Mental Philosophy, as forming two series of Lectures, from the consideration of the infinite importance of the science of Self-Knowledge; reminded of the ancient heathen saying, which the Greeks affirm was sent down from the gods,—"Man, know thyself;"—of the maxim of one of our philosophic poets,—

"The proper study of mankind is MAN;"

and of the exclamation of the devout Psalmist;—"I will praise thee, O God; for I am fearfully and wonderfully made: marvellous are thy works; and that my soul knoweth right well. My substance was not hid from thee, when I was made in secret, and curiously wrought in the lowest parts of the earth. Thine eyes did see my substance, yet being imperfect; and in thy book all my members were written, which in continuance were fashioned, when as yet there was none of them."—Psalm cxxxix. 14—16.

The word ANATOMY is derived from two Greek particles, ανα, through; and τομη, a cutting. The word thus literally signifies to cut through, or to cut asunder; dissection, or a separation of the parts. As an ART, therefore, anatomy means simply the operation of dissecting, or artificially separating the parts of an animal body; but as a SCIENCE, it comprehends all the objects of such dissection; which, in general, are, to discover the various situations, figures, and connections, powers and

uses of the parts, with the structure, fabric, and economy of the whole. This science is usually divided into ANATOMY, properly so called, or HUMAN ANATOMY and COMPARATIVE ANATOMY. The former of these is usually applied to the examination of the structure and parts of the human body; the latter to that of the brute creation only.

The science is believed to be very ancient, although many ages passed before it was brought to any degree of perfection. It would appear that Solomon, king of Israel, who was a profound natural philosopher, knew something of Anatomy, from some remarkable passages in the book of Ecclesiastes.

Hippocrates, the most eminent of the Greek physicians, and styled the father of medical science, is the first author who treated of anatomy scientifically. Galen is, by general consent, acknowledged the prince of anatomists.

The importance of this study cannot be over-rated in the education of the MEDICAL PROFESSION; it lies at the basis of all correct knowledge of the functions of the human body. Diseases cannot be properly understood without it; and it has been through its agency that many of the successful operations of surgery have been introduced. But anatomy is of use also in painting and statuary. Some of the great masters of these arts have paid particular attention to this study in order to give correct representations of the limbs and muscles of the human frame.

A general knowledge, however, of the structure and functions of the human body, is useful to ALL PERSONS, as it may often be the means of preserving their health, and preventing many of the accidents which occur to life through ignorance. This science furnishes us with the most striking and convincing proofs of the wisdom, power, and goodness of the Creator; for the instances of benevolent contrivance, which every moment meet our view, are such as can hardly fail to strike the most careless or most prejudiced observer.

I. The first subject on which we shall now treat will be

THE HUMAN SKELETON.

A skeleton is the bones of an animal body separated from the flesh, and retained in their natural position and connections. The human skeleton is divided into three principal parts,—the Head,—the Trunk,—and the Extremities or Limbs.

II. In the examination of the skeleton we naturally direct our attention, in the first place, to

THE SKULL.

This is the bone that forms the exterior of the head, and encloses and defends the brain. It properly consists of three principal parts,—the frontal, including the forehead and bones of the nose, eyes, and upper and lower jaws; and two side-bones. The upper bones of the skull are closely united by a rough edge, like that of a saw, the notches of which shut in to each other, as the teeth of a saw would do, and form what may be called seams.* These seams are by anatomists called SUTURES. In early infancy, the parts of the skull, especially at the top of the head, are very imperfectly closed; so that you might feel, by the slightest pressure of your finger, the pulsations of the brain very distinctly. In process of time, however, the bones become more closely united, and at length are as firmly compacted as if there had never been any separation of the parts. As a person advances in life, these seams begin to be obliterated; till, in very old age, not a vestige of them is to be seen. The thickest bone in the skull is situated in the back of the head; which defends that part of the brain, the least injury to which proves fatal. It may further be observed, that when we fall forward, the hands contribute to protect us; and if we fall on one side, the shoulder in some measure protects the head; but if backwards, there is nothing to interpose, and the back of the head comes with great force to the ground; it was therefore necessary that the bone placed there should have some strength.

Admire here the wisdom and goodness of the Creator in forming so strong a bone as the skull to defend the brain, which, if injured, occasions idiocy, madness, or death.

III. From the back and lower part of the skull descends a series of bones called

THE VERTEBRÆ.

This is sometimes termed the spine, or back-bone. In the figure in the Frontispiece the upper part of the spine is marked *á*, and the lower *a*. The name VERTEBRÆ is derived from the Latin word VERTERE, to turn, as the body turns upon them as

* See Skull in Frontispiece.

on a pivot. The first upper vertebra is called ATLAS, from its supporting the globe of the head, and is united to it by a hinge or joint, upon which the head plays freely forward or backward, to the right or left, as far back as is necessary.

The bones which compose the vertebræ are twenty-four in number. These having a hole in the middle of each, about the size of a little finger, are placed over each other, forming a canal or channel for the spinal marrow. Between these bones is a tough substance or gristle, very yielding or elastic, almost like India rubber. This keeps the bones from wearing out too fast when they move, and yet allows of their moving pretty freely. "The spine is, really, one of the most curious things in nature. Rope dancers and tumblers will bend their heads back till they almost touch their feet, and bring this straight pile of bones nearly into the shape of a bow. This gristle or cartilage between the vertebræ is so elastic or springy, and also so readily compressed, that people who stand or walk much, are really a little shorter at night than they are in the morning. Rest gives the elastic cartilages time and opportunity to spring back again into their places while we sleep, so that by the next morning we are as tall as ever. It is a fact that old people settle down a little, and are not so tall as in middle age; which is partly owing to these cartilages yielding and yielding till they become at length somewhat thinner."*

You may observe the structure of the vertebræ in a loin of veal; and the back of a hare or rabbit affords a good view of the mode and firmness of the union between them.

Some conception of the strength of the vertebræ may be formed, when we consider the enormous loads which some strong men are able to carry on their backs.

IV. We have now to treat of

THE BONES

of the human frame in general. These consist of a white, hard, brittle substance, supporting and forming the stature of the body, constituting its frame-work, defending its fleshy parts, and giving power to the various muscles.

The number of distinct bones in the human body is about two hundred and fifty, presenting every variety of size and figure, from the bone of the leg, or thigh-bone, which is the

* "House I Live in," p. 41; from which valuable little work the author has derived many useful hints.

largest, to the minute bones of the ear, which are the smallest. The bones are, generally speaking, of three kinds—long bones, broad or flat bones, and round bones. The long bones are hollow, having a channel throughout their entire length, which contains marrow. The broad or flat bones, which are rather of a spongy character, are chiefly those of the head and hip-bone; and the round bones are those of the joints. "There is, undoubtedly, LIFE, (though we hardly know what life is,) in bones. While we continue in good health, and the functions of the body are duly performed, there is not much feeling in them; though in some cases of disease they are endued with exquisite sensibility. When the surgeon amputates a limb, the proceeding of sawing through the bone is the least painful part of the operation; though people in general imagine that it is highly so."* When a bone is broken, it is not the bone that feels so much as the nerves that surround it.

The entire bones of the human body, when perfectly dry, weigh from twelve to twenty pounds. These are the last remains of the human frame. In ancient times, survivors of relatives and friends were very careful about the bones of the departed; keeping them entire, or reducing them by fire to ashes, and then preserving them in urns or vases. An inspired writer in the sacred volume tells us that Joseph "gave commandment concerning his bones;" and Moses, when he and the children of Israel left Egypt, "took the bones of Joseph with him." The structure and functions of the human body display, in a striking manner, the skill and goodness of Him "in whom we live, and move, and have our being." "All my bones shall say, Lord, who is like unto thee?" Psalm XXXV. 10.

The study of the bones is called OSTEOLOGY, from Ὀστέον, a bone, and λογος, a discourse.

We now proceed to notice some of those bones which have not yet come under review; such as

1. The RIBS (fig. *r r*). There are twelve of these curved bones on each side of the body, making twenty-four. They proceed from the vertebræ, and come round to the front of the body; seven of the upper ribs on each side, are united to the STERNUM, or breast-bone (fig. *x*), and are called TRUE RIBS: the other five, which are not so joined, but are united to the upper ones, or hang loosely at one end, are called FALSE ribs. "In the old by-gone days of ignorance and superstition, a notion

* "House I Live in," p. 33.

prevailed, which is not yet wholly extinct, that the MAN has one rib less on one side than on the other. It was said that as Eve was formed of a rib taken from Adam's side, he and all his male posterity, have one rib the less for it. We hardly need say that this notion is wholly unfounded." Facts are against it, as man has the same number of ribs as woman. Whether in the case of Adam, the Creator substituted another rib for the one taken away, we need not inquire. It is probable that a portion of flesh as well as bone was taken from the side of Adam; for when the woman was brought to him, he said, "This is now bone of my bones, and flesh of my flesh." Gen. ii. 23.

In the position and form of the rib-bones we see what a wise and kind provision has been made by God for the defence of the heart and lungs—the seat of life. These are the walls of the citadel—the guards of vitality. We read in sacred history of one or two men who were assassinated. The assassins knew where to plunge the dagger; for we are expressly told that they smote the victim "under the FIFTH rib;" that is, under the protecting ribs. It was at this particular part, on the left side, that the soldier thrust his spear, when he pierced the heart of the Redeemer on the cross. But while the ribs thus protect the vitals of the human frame, the arms and hands are a sort of outer-guards, defending the ribs and other parts of the body.

2. The COLLAR-BONES (fig. *y y*), termed the CLAVICLE, are, in form, like the ribs, and extend outwards from the top of the upper arm bone to the neck, or the top of the breast-bone.

3. The SHOULDER-BLADE is the broad flat bone lying at the upper part of the back, and which is so troublesome to many young ladies by its unseemly projection. In the upper part of it is the hollow or socket, in which the round head or ball of the large arm-bone lies and moves. Its form is not much unlike that of a shoulder of mutton. It is called the SCAPULA.

4. There are two bones called the PELVIS, or HIP-BONE (fig. *s s.*) The word pelvis signifies a basin or bowl; and the bone is so called because it helps to contain and support the lower parts of the body. In the centre of the pelvis is a bone denominated the SACRUM, upon which the spine or back-bone rests. (fig. *w.*)

5. The ARM-BONES consist of one upper,—named the HUMERUS (fig. *b b*), and two lower, called the RADIUS (fig. *d d*), and the ULNA (fig. *e e*), or *cubit*, as the cubit is the length of a

man's arm from the elbow to the extremity of the little finger. The connection of the bone at the shoulder is such that the arm can be moved in almost every conceivable direction. The two lower bones are joined to the upper at the elbow (fig. *c c.*) This elbow-joint admits of only one sort of motion, viz., forward and backward, like a door on its hinges. Then the WRIST,—(fig. *f f,*) consisting, as it does, of eight bones, all moveable, and being so connected with the lower bones of the arm as to admit of very free motion,—renders the arm one of the most useful contrivances in the world. It will perform movements as various and as rapid as the trunk of the elephant; and would probably, if it were not so common, excite as much surprise.

6. From the bones of the pelvis or hip-bone proceed the LEG bones. The bone of the THIGH (fig. *i i*), called the FEMUR, is the largest and strongest bone of the whole human frame. At its upper end, where it is connected with the hip-bone, (fig. *h h,*) is a round knob or head. This head fits into a corresponding hollow, or cavity of that bone, and is fastened there by strong flexible ligaments or gristly straps. The leg below the knee consists of two bones, the larger called the TIBIA, (fig. *m m,*) so named because it resembles a tube, or pipe, or hautboy; and the smaller, termed the FIBULA (fig. *n n*); the latter descending from the upper side of the former to the ankle. At the knee there is a small detached round flat bone, called the KNEE-PAN, or the PATELLA, (fig. *k k, l l,*) kept in its place by what are denominated TENDONS; this protects the front of the knee-joint. It will be perceived that the leg bones are very similar to those of the arms.

7. The bones of the HAND and FOOT, (fig. *g g, p p,*) are very remarkable. The whole hand with the wrist contains twenty-seven bones. The four longest bones support the palm of the hand, and are joined at one end to the wrist bones, and at the other to the first joint of the fingers. Each of the four fingers has three bones; the thumb only two.

The bones of the foot have a general resemblance to those of the hands. The foot is composed of twenty-six little bones, strongly fastened together by gristles and ligaments. These ligaments yield, when we bear upon the foot, just enough to enable it to conform to the surfaces on which we tread. The instep is the forepart of the upper side of the foot nearest its junction with the leg. The ankle, (fig. *o o,*) is the joint which connects the foot with the leg. The bones of the feet assist us in

preserving our balance, and in standing upright, and also enable us to perform several progressive motions with greater ease.

Before we dismiss the subject of bones, we must say a few words on

8. The TEETH. These are instruments for laying hold of, and masticating or chewing solid food, breaking it into small pieces, and mixing it with saliva or spittle; thus preparing it for more easy digestion in the stomach. They are situated in the jaws, and have a very complicated structure. When the number of teeth is complete, in an adult person, and none have been lost, or extracted, each jaw contains sixteen; and both together, of course, thirty-two. There are four kinds of teeth in each jaw, viz., four front teeth, two canine or dog's teeth, called also eye-teeth, four small grinders, or double teeth, and six large grinders. Of these, half are, of course, on each side. To prevent the teeth from wearing out, as a piece of common bone would do, the crown or body of the tooth, which is that part we see above the gum, is coated all over with something much harder than any bone in the human body. It is called ENAMEL. "Hard as it is, however, enamel will wear out in time. It will wear out much sooner if the teeth be picked with pins and needles. These things are too hard, even for the hard enamel, and are apt to crumble it off. So is the practice of cracking nuts with the teeth; or, indeed, the biting of any substance harder than the crust of good dry bread. If accustomed to bite nothing harder than that is, and if not injured in any other way,—for there are many ways of injuring the teeth, (such as by very hot water, acids, sweets, &c.),—they may, perhaps, last all our lives, as in the case of other animals, and the uncivilized race of man. But if the enamel once gets broken, or removed, so that the air is admitted to the softer bone under it, and affects the nerve, the seat of tooth-ache, which passes through it, the tooth soon becomes hollow or decays. Like any other part of this wonderful frame which God has given us, the teeth will, however, last the longer for being *moderately* used."* Those kinds of food and drink which injure the stomach, also injure the teeth, and cause the enamel to become soft and break away. One thing more, however, as a practical hint,—the teeth must be kept clean. Let the tooth-brush be in constant use. This is a practice, no less

* "House I Live in," p. 64.

required by delicacy than by a due regard to health and comfort, to the preservation of the teeth themselves, and as a means of escape from the racking torments of the tooth-ache. What an advantage and a blessing is a good set of teeth! With many people they are one of the principal marks of beauty; and so long as they remain sound, are, we all know, most useful, as well as handsome; and, by care and attention, especially in the season of youth, they may remain sound, and useful, and beautiful, all your days. It may be asked, Why are not children born with teeth? We reply, because teeth would be useless to the new-born infant; and would cause pain to the mother in suckling it. It is therefore wisely provided that the teeth shall not appear till about the time of weaning the child.

There are other distinct bones which might be mentioned, such as the small and delicate bones of the ear, which we must now pass over.

9. The various limbs and bones which constitute the human frame are all severally united together by numerous JOINTS.

These are to be found at the neck, shoulders, elbows, wrists, fingers, hips, knees, ankles, insteps, feet, and toes. There are, in general, two kinds of joints,—the *hinge* joint, and the *ball-and-socket* joint; in the latter, the end of one bone is formed into a rounded head or ball; and this is received into a corresponding socket or cup in the other. Of the hinge joint we have examples in the elbow, the knee, and the joints of the fingers and toes. Of the perfect ball-and-socket joint, we have in Man only two examples,—the shoulder and the hip. In the former, the socket is much shallower than in the latter, and therefore is more liable to dislocation. These joints are connected together by a strong supple ligament,—a white shining substance,—attached to, or growing out of the bone. This you may easily notice at any time in severing a shoulder or leg of mutton. "Now what prevents the joints of the human body from rapidly wearing out, when we walk much, or run swiftly? The Father of the universe is the Preserver, as well as the Creator, of this 'wondrous frame.' Were there not something done to keep these joints oiled, if we may so call it, they would not last long. Take the knee, for instance, and think what a vast deal of friction or rubbing together of the end of the thigh bone and of the two leg bones there must be! Now the

Author of the human frame has so contrived it, that a substance, called SYNOVIA, (a Greek word, signifying the white of an egg, which it resembles,) which answers all the purpose of oil, continually oozes out in the inside of the ligaments at the joints, and keeps the ligaments themselves, and the joints, soft and moist. Can anything be more curious? Can anything prove more clearly the wisdom and goodness of a great Designer?"*

In speaking of the joints of the human frame as exhibiting a proof of the existence and wisdom of the Creator, I am reminded of an anecdote which I once heard the eminent Missionary, Mr. Williams, relate. Two captains of an English vessel touched at Raiatea, one of the South Sea Islands, whose inhabitants had recently been converted to Christianity. In conversation with Mr. Williams, these gentlemen wished particularly to know whether the natives embraced Christianity on the bare representations of the Missionaries, or whether they really understood its principles. Mr. W. called some of the converts together to answer for themselves. One of them, on being asked what reason he had to believe in the existence of God, as the Creator of all things, replied, "When I look at myself, I find that I have HINGES all over me,—hinges at my fingers; at my elbows; at my jaws; at my knees, and at my feet. If a thought arises in my mind, it moves these hinges. If a thought comes into my mind that I must go somewhere, it moves the hinges of my feet. If I want to speak, it moves the hinges of my jaws, and so on." This reply, though coming from a lately untutored savage, was philosophy worthy of a Bacon or a Paley.

"In considering the joints," says Paley, "there is nothing, perhaps, which ought to move our gratitude more than the reflection, *how well they wear*. A limb shall swing upon its hinge, or play in its socket, many hundred times in an hour, for sixty years together, without diminution of agility; which is a long time for any thing to last, for any thing so much worked as the joints are."

Upon the skeleton, with all its bones, which is the framework of the human body, and which, not being intended to be seen, possesses no qualities pleasing to the eye, the whole remaining substance of the body is arranged and supported.

* "House I Live in," p. 76.

V. We now proceed to

THE MUSCLES.

A great portion of the soft substance of the body consists of what is termed fleshy or muscular fibre. In popular language, the muscles are the *flesh*, that is, the lean part of it, which is of a red colour, caused by the blood which tinges the whole substance. The beef and mutton that we eat are the muscular substances of the ox and the sheep. The muscles themselves are thready, stringy, or fibrous. They, with what is termed their TENDONS, or *sinews*, are the instruments by which animal motion is performed. They are wonderfully susceptible of contraction and relaxation; or of being drawn in or stretched out. These muscles may be distinctly seen and understood by looking at the bony end of a leg of mutton or veal. Those pieces which appear to be united together by a glutinous substance, and which may be easily separated, are muscles. The largest and most visible muscles of the human frame are those of the calf of the leg, and of the upper part of the arm. Now these muscles in the human body are divided into upwards of four hundred bundles, forming several layers placed over each other, infinitely varied in size and strength according to the purposes which they are designed to serve.

The TENDONS, which are the beginnings or endings of the muscles, and in general connect muscles to bones, are distinguished from the flesh by being smaller, firmer, and stronger: they are a kind of straps, and are of a glittering silver-colour. These tendons may be traced under the skin on the back of the hand, and in the very powerful specimen at the heel, called the "tendon of Achilles." "The muscles are those parts by which the head and limbs are moved, and by which locomotion generally is effected. In short, from the most rapid and energetic movements which we are capable of performing, to the slightest motion of the little finger, or the eye-lid, all is performed by the aid of the muscles." The study of the muscles is called MYOLOGY, from Μυς, a muscle, and λογος, a discourse.

VI. The next subject we briefly notice is

THE CARTILAGES.

By these are meant what we commonly call *Gristle*, which is

a smooth, solid, flexible, elastic substance, softer than bone, of a pearly colour, without cells or cavities. The nose, ears, and windpipe are the principal cartilaginous or gristly parts of the human body. The cartilage does not, in ordinary cases, unite when torn or divided. "These injuries, however, are sometimes repaired in various ways. The uniting medium is never found to be new cartilaginous tissue, but is a substance sometimes like ligament, and sometimes of a bony structure." Cartilage serves to connect the bones of the vertebræ, and is essential to their various movements. Its general uses are to prevent the bones from being injured by continual friction, and to join them together: it also contributes, in a great measure, to the well-forming of several parts of the body, as the nose, ears, &c.

VII. A few words on

THE NERVES.

The Nerves are small, firm, white, pulpy cords; and are prolongations of the *medullary* or marrowy substance of the brain and spinal marrow, which ramify and extend chiefly in pairs to every part of the body, endowing it with sensation and voluntary motion. They serve at once to convey the information of the senses to the mind, and to transmit the will of the mind to the muscles. The brain itself, the spinal marrow, and the nerves, are collectively called the NERVOUS SYSTEM, because they are apparently united in one order of functions. The nerves are divided into nerves of motion and nerves of sensation; nerves of the special senses, nerves serving for nutrition, respiratory nerves, &c. Most of the nerves are exquisitely fine in their texture; a few only—for example, the *sciatic* nerve, or that pertaining to the hip—being of larger diameter. They divide as minutely as do the arteries and veins, which is proved by the fact that we have feeling almost everywhere, externally and internally. A puncture with the point of the smallest needle gives us pain; but this could not be, unless there were nerves in the part which is wounded. The uses of these nerves are, as we have just hinted, to convey sensation from the various parts of the body to the brain, which may be considered as their common centre.

There are, in some parts of the body, what are called GANGLIONS, or knots of nerves, which are whitish-red bodies, of various sizes and figures, the use of which is wholly unknown.

The study of the nerves is called NEUROLOGY, from Νευρον, a nerve, and λογος, a discourse. Hence also the word NEURALGIA, or pain in a nerve, given to that distressing malady, the TIC DOULOUREUX, the cause of which is unknown, and often baffles the skill of the physician.

VIII. The next subject which comes under consideration is

THE SKIN.

This, to give a general definition, is the natural covering of animal bodies. It consists of three layers or coverings. First, the EPIDERMIS, *cuticle*, or scarf-skin, is the outermost of the three layers. A blister on your hand would easily show you this. It is a thin insensible membrane, has no blood-vessels or nerves, and consequently neither bleeds nor feels pain when cut or abraded. This skin considerably varies in thickness: it is extremely delicate, for example, in the lips and tongue; very thin at the finger-ends and on the face; and very thick on the soles of the feet and palms of the hands. "This latter is manifestly the intentional work of the Creator, for it is perceptible even at birth, before use can have exercised any influence. . . . . When a part is much used, the cuticle covering it becomes thicker and thicker within certain limits; till, in extreme cases, it becomes as thick, hard, and resisting as horn. It is this thickening of the epidermis on the lady's finger that alone enables her to ply with impunity that important instrument the needle." The same effect is produced on the fingers in playing the harp. "And it is the same thickening that fits the blacksmith and the mason, the stone-breaker and the boatman, to ply their trades, without that painful blistering which the young apprentice or unaccustomed labourer so regularly undergoes."* The second skin, or MUCOUS COAT, is a thin layer of soft or pulpy matter, which performs the *secretions*, or the separation of matter from the blood, and is the seat of colour. The outer skin is in colour exactly alike in all people, whether black, red, copper, or white; yet this second under skin in the African is black; in the native American, it is red or copper-coloured; in the Asiatic it is tawny or yellow; and in the European white. If a Hottentot were to blister his hand, the skin that would rise would be as white as yours. Here, then,

* Combe's "Principles of Physiology," p. 45.

you see the cause of that variety of colour which exists among the different families of the human race. The third skin, called the CORIUM, is the *true* skin, of which, in inferior animals, leather is made; and which, when boiled in water, is converted into glue. This skin seems to be composed almost entirely of blood-vessels and nerves. The universal and equal redness of the skin in a blushing face, is a proof of its being filled with blood. This skin is the seat of sensation and of touch, and the instrument of perspiration and absorption, the right condition or disturbance of which, is a most powerful agent in the preservation or injury of the health. It is affirmed by some, that "during twenty-four hours, the skin discharges two pints or more fluid, by invisible perspiration; and a much greater amount when, by exercise or heat, it sensibly bedews the surface. It is said, indeed, that a robust man, engaged in hard labour, and exposed to intense heat [as the glass-blower, sugar-baker, &c.], has been known to lose five pounds weight in the course of an hour."*

If persons in general were aware of the important offices which the skin sustains, and how necessary it is, for the proper discharge of its functions, that the pores should be kept free from obstruction,—for the skin is extremely porous, or full of holes,—there would be much more attention paid to the habitual and thorough cleansing of the body, and the frequent and regular change of apparel; thereby preventing fevers, inflammations, &c. "Every one knows that the skin perspires, and that checked perspiration is a powerful cause of disease and of death. When the body is overheated by exercise in warm weather, a copious sweat soon breaks out; which, by evaporating, and so carrying off the superfluous heat, produces an agreeable feeling of coolness and refreshment. . . . . But in the ordinary state, the skin is constantly giving out a large quantity of waste materials by what is called *insensible* perspiration; a process which is of great importance to the preservation of health. . . . . There is a close sympathy between the skin and the stomach and bowels; and most of the obstinate eruptions which appear on the face and the rest of the surface, owe their origin to disorders of the digestive organs, and are most successfully cured by treatment directed to the internal disease. . . . . So perfect is the sympathy between these two distinct parts or organs, that when the skin is primarily affected, the

* "The Philosophy of Life, Health, and Disease," by C. Searle, M.D., p. 23.

stomach becomes secondarily so, and *vice versa;* so that a sudden check to the heat of the body as often brings disease of some internal organ, as if the cause were applied directly to the organ itself."*

IX. There is another substance of the human body which we must not pass over; namely,

THE FAT.

In most parts of the body, the fat lies immediately under the skin. It is generally white or yellowish. There is in most persons a small quantity of fat intermixed with the muscles; and in some persons a great deal of it. A small portion only of fat is necessary to health, and when found, as is frequently the case, in unusually large quantities, in man, or in other animals, it rather indicates disease. The fat affords, by its power of resisting the passage of heat, a warm covering to animals that are destined to live in cold climates; and it is in these that we find it accumulated to the largest amount. Animals which inhabit tropical or hot climates, possess very little fat. The fat, being deposited when nourishment is abundant, serves as a store which may be taken back by the blood-vessels into the system, and made use of in time of need. In diseases which prevent the reception of food, the fat in the body rapidly diminishes. This is the case, too, with those animals that *hybernate*, or sleep during the winter. These animals usually accumulate a considerable amount of fat in the autumn, and are observed to come forth, on the return of spring, in a very lean condition.

The fat is supposed to be insensible, unconscious of pain, as none of the sensitive nerves pervade it. Hence it is used in the Holy Scriptures as a figure denoting moral insensibility,—want of feeling. The charge brought against Israel was,—"This people's heart is waxed fat."

X. I close with a few words on

THE NAILS AND HAIR.

1. The Nails are a horny substance growing at the end of

* Combe's "Principles of Physiology," pp. 50. 59.

the human fingers and toes. They belong to the epidermis, or outer skin, and separate with it; and like it, they have neither blood-vessels nor nerves, and may be cut or bruised without pain. In the fingers they increase the power of apprehension, being useful in laying hold of and retaining objects. We cannot say of what use are the nails of the feet, except as a slight protection to the toes. In a delicate, well-formed foot, however, they may be considered as an ornament. Were the human foot left at liberty as it was among the ancient Jews, Greeks, and Romans, who wore sandals only, it would be much more comely in appearance than it now is, cramped by tight boots and shoes, the prolific source of that malady which frequently proves a too sensitive and accurate barometer, and furnishes ample employment and cash for many pretending chiropodists.

2. Hair, in greater or less quantity, is found on all parts of the body, excepting the palms of the hands, and the soles of the feet; but more particularly it abounds upon the head. Each hair is a hollow tube supposed to contain some kind of matter. Hairs have their origin in little roots or bulbs which are situated in the lower or true skin. Neither nerves nor blood-vessels pass into the substance of the hair. There is an evident relation between the colour of the hair and the shade of the skin. Dark-skinned individuals have generally dark hair; while the hair of fair persons is usually of a light colour. The hair, especially that of the head, and of the eyebrows and eyelashes, serves in general for the ornament, warmth, and protection of the different parts of the body. In many instances, the hair of the head loses its natural colour by age, and turns grey or perfectly white: and "the hoary head is a crown of glory, when it is found in the way of righteousness."

SECOND LECTURE.

THE present Course of Lectures is on MAN. The constituent and essential parts of man are two,—body and soul. The one was made out of the dust; the other was "breathed into him." The body is formed with the greatest precision and exactness; every bone, muscle, vein, artery,—yea, the least fibre, in its proper place; all in just proportion and symmetry, in subserviency to the will of each other, and for the good of the whole. It is also made erect, to distinguish it from the four-footed animals, which look downward to the earth. Man was made to look upward to the heavens, to contemplate them, and the glory of God displayed in them; to look up to God, to worship and adore him. It is this erect posture which gives to the aspect of man that dignity becoming his high place in the creation.

> "Os homini sublime dedit: cœlumque tueri
> Jussit, et erectos ad sidera tollere vultus."—OVID.

By the adaptation of an erect structure, also, his hands are left disengaged, and ready for the numerous operations to which he is inclined by his judgment, or urged by his wants.

"The general stature of the human being is between five and six feet. The infancy of man is longer than that of other animals: he does not attain his full growth till he is upwards of twenty years of age. For other thirty years, if not cut off by disease, he is in the prime of his strength. Twenty years more constitute elderliness; and if he survive seventy years in all, he is said to reach old age."*

The subjects of my last Lecture were—the Human Skeleton;—the Skull;—the Vertebræ;—the Bones, including the Ribs, the Collar-bones, the Shoulder-blade, the Arm and Leg bones; the bones of the Hand and Foot; and the Teeth; adding a few words on the Joints. Then followed the Muscles and Tendons; the Cartilages; the Nerves; the Skin; and a few brief observations on the Fat; the Nails; and the Hair.

* Chambers's "Introduction to the Sciences," p. 120.

We now proceed to notice the more internal parts of the human frame; beginning with

I.—THE BRAIN AND SPINAL MARROW.

The structure of the BRAIN is so complicated, that less is known of its true nature than of that of almost any other organ. It is that soft and whitish mass of pulp enclosed in the skull, from which the nerves and spinal marrow proceed. It is said to be furnished with a three-fold greater proportion of blood than any other organ. This mass is divided into two halves, termed *hemispheres*, resembling a boiled egg without the shell, cut down lengthwise. Each hemisphere is again sub-divided into a front, middle, and back *lobe* or lump. "The white substance of the brain is usually described by two names; the upper and front part, which is by far the largest, is termed the *cerebrum;* and the lower portion is named *cerebellum*, or little brain; both of which, being united together, are closely and firmly enveloped in three distinct membranes, or coats; and the whole weight of which, in an ordinary sized man, is about three pounds."* The entire brain is again further separated into numerous small lumps, termed *convolutions*, which run in different directions, and may be compared to a mass of white soft sausages intertwined and gently compressed together. In the cerebellum there is what is called the *arbor vitæ*, or tree of life; which has all the appearance of a beautiful display of the branches and twigs and leaves of a tree. "The brain of the human being is supposed, by some, to attain its full weight and size at seven years of age; by others it is supposed to increase in weight till the age of fourteen. Idiots' brains are usually very small, weighing only about twenty or twenty-five ounces. But the size of the brain bears no constant relation to the *genius* of the person."† It is a striking fact, however, that almost all those persons who have been eminent for the amount of their acquirements, or for the influence they have obtained by their talents for command over their fellow-men, have had large brains; this was the case, for example, with Newton, Cuvier, and Napoleon. The brain contains seven cavities, or hollow places. In their natural size, these are exceedingly small; yet by disease they are sometimes enlarged enormously, and being filled with a watery fluid, produce that dis-

* Chambers's "Introduction to the Sciences," p. 120.
† Knox's "Manual of Anatomy," p. 547.

tressing malady commonly known as *hydrocephalus*, or water in the brain. A cure for this, in children, has lately been discovered, by perforating, or making a hole in the top of the skull, and drawing off the water by a syringe. The brain is said to be larger in man, in proportion to the nerves belonging to it, than in any other animal. It is conjectured by some to be the grand and primary organ of sense, with which the mind is supposed to be most immediately and intimately connected, and from which the Nervous Influence is found to be communicated to all the other parts of the body. By others, however, it is maintained, that the immaterial, immortal spirit in man, does not reside exclusively in any one part; but lives in all parts of the brain, spinal marrow, and nervous system in general.*

As a proof of the connection of the brain with the other parts of the body,—with the stomach, for example,—if a person receive a violent blow on the head, he becomes sick; or if the stomach be disordered, head-ache is frequently the consequence. Take another instance. A man once came to Sir Astley Cooper, complaining of a dreadful pain in his back, which made him stoop, so that he could not lift himself up. Sir Astley examined his back, but could find nothing the matter there. The man said he had lately been fighting, and had had several heavy falls. The surgeon then examined his head, and there found a small bit of his skull broken in, and resting on the brain. With an instrument, Sir Astley lifted up the piece of skull; the man at once rose up, and felt perfectly relieved. Thus the *seat* of pain was in the back; the *source* of it in the head.

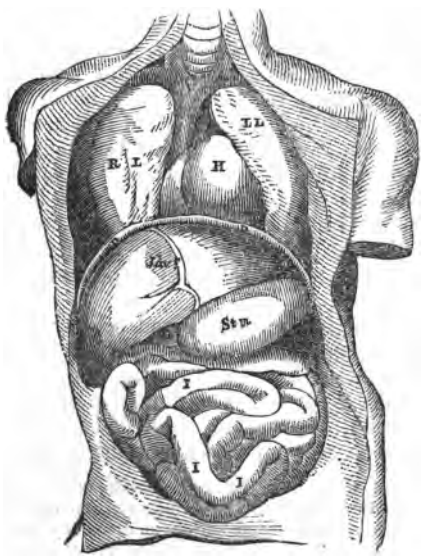
The brain being so important, and tender, and delicate a portion of the human frame, is providentially protected by an arch of the firmest construction, viz., the skull.

2. The Spinal Marrow is a continuation of the substance of the brain, passing, like a white cord, down the vertebræ, or back-bone. From this are given out thirty pairs of nerves,

* Phrenologists assert that the brain consists of thirty-five organs or faculties. These they divide into two kinds, viz., *feelings* and *intellects;* and these are again divided and sub-divided. They, moreover, assert that the protuberances in the skull correspond to the size of the particular organ in the brain within; a small faculty being an indication of small power, and a large one *vice versa*. Now that there is truth in Phrenology, so far as regards the position and size of the brain, we think is evident; but of the particular mapping of the skull, as adopted by Phrenologists, we may be allowed at present to remain in modest doubt.

which, in conjunction with those arising from the brain, communicate energy and feeling to the whole body; and also by their extreme sensibility, convey to the brain the slightest as well as the strongest impressions made upon the different organs; hence our pleasures and our pains, our hopes, our fears, and our affections. The least injury done to the spinal cord, even so much as the prick of a pin, causes death. By striking at the spinal marrow, at the back of the head, the animal, under the butcher's hand, is at once brought low, and lies dead at his feet. At the gallows, when the body falls, the neck is dislocated, the spinal cord is broken, and instant death is the result.

We see, however, what care the Creator has taken of the spinal cord, in causing it to pass down the centre of some of the strongest bones of the body. Solomon, no doubt, refers to this in his expression—"Or ever the *silver cord* be loosened."



We proceed now to

II.—THE HEART, with its *arteries* and *veins*.

1. The HEART is a hollow, strong muscle, or piece of flesh, in

form something like a pear. Its size varies in different persons; it is not much larger than a man's fist, being nearly the size of the heart of the calf. It is generally about six inches long; and, at the upper part, four or five inches wide. It is situated in a slanting position on the left side of the body, just under the upper or true ribs; and is embedded, as it were, in the left lung. (See fig. H.) It is surrounded by a membrane or pouch called the *pericardium*, (a word which means round the heart.) This membrane secretes and contains about a spoonful or two of limpid fluid, resembling water, which prevents the surface of the heart from becoming dry by its continual motion. It was this which was pierced by the soldier in the body of the Redeemer, when he hung upon the Cross, and from which the water flowed mingling with, or followed by, the blood. John xix. 34.

The weight of the heart is usually from ten to fifteen ounces. It is the centre of the circulation of the blood; acting like a force-pump for sending the blood through the various arteries or channels of the body; and may be likened to the water-works which send water through a town in pipes. How minute and multiplied the ramifications of the blood vessels are; and how thickly spread over the body, is proved by the fact, that we cannot prick the point of a pin into the flesh, without drawing blood; that is, without finding a blood-vessel. The heart is a double organ; one half presiding over the circulation in the lungs, and the other over the circulation in the rest of the system, or the body at large. The right side of the heart, which is the smaller, is divided into two cavities or chambers, called *auricles* and *ventricles*. The left side of the heart is also divided into two cavities; but these are larger and more strongly constructed than those on the right side; having to conduct the circulation through all parts of the body, except the lungs. By the contraction of the ventricles, the blood is sent into vessels, called

2. ARTERIES, and carried by them to every part of the frame, for the purposes of nourishment, preservation of life, the production of warmth, and the secretion or absorption of different fluids. There are, strictly speaking, but *two* arteries; the PULMONARY artery, which proceeds from the right ventricle of the heart; and the AORTA, which proceeds from the left ventricle. All the others are only ramifications or branches of these; they are, however, all denominated *arteries;* and each has its appro-

priate name. The motion of the blood in the arteries is called the *pulse*, which corresponds with the beating of the heart. The pulse may be felt in various parts of the body; but the most usual place of feeling it, as most convenient, is at the wrist. From seventy to eighty strokes of the pulse in a minute, are commonly that number which, in an adult person, is considered, as far as the pulse is concerned, to indicate health. In children, however, the pulse is much quicker, and in old persons slower. The number of contractions or beatings of the heart, which, of course, occasion these pulsations, is rather greater in the standing position than in the sitting posture; and in sitting, than in lying down. It is increased by exercise, especially by ascending a steep hill, or going up stairs; and also by any mental excitement.

Wounds in arteries are always dangerous, and very frequently mortal; hence the wisdom evinced in the structure of man. All the arteries are deeply embedded in flesh, or other surrounding substance; while the veins, a wound in which is comparatively unimportant, are plentifully scattered on the surface of the body. When the blood has been sent up, from the left side of the heart, by means of the great artery called the AORTA, it spreads in innumerable vessels over the whole body; but when they arrive at the extremities, at the end of the fingers and toes, for instance, the blood is taken up, or re-collected by another system of vessels, termed

3. VEINS, which are also spread over the whole body, and bring the blood back to the right auricle of the heart. There is no pulse in the veins. The blood flows through them very slowly. In going out of the heart, it passes from wider into narrower tubes; and in coming back, from narrower into wider. The blood having now passed through every portion of the body, comes back to the heart in a dark, red, impure state. It is then propelled by the contraction of the heart into the large artery, called the PULMONARY artery; leading directly, by separate branches, to the two lungs; where it is purified by the air, which is drawn into them, and then passes into the left ventricle, the point from which it started; and now, being oxydized or cleansed, is of a bright red colour, and is distributed anew over the frame. "Thus there are two distinct circulations, each carried on by its own system of vessels: the one, from the left side of the heart to every part of the body, and back to the right side; and the other, from the right side of

the heart through the lungs, and back to the left. The former has for its object nutrition and the maintenance of life; and the latter the restoration of the deteriorated or impure blood."*

As the pure air which we inhale, or draw in, purifies the blood, it is of importance that we do not breathe the same air again and again, which we may do in a small, confined, crowded room. If the air we breathe is not pure, it does not sufficiently change the blood from its black to its scarlet colour. "It is consequently sent back to the heart, and distributed all over the body, in a state totally unfit for the purposes for which the great Creator designed and gave it; and if this abuse is long permitted, the health materially suffers. Instances have been too frequently before us in the crowded state of lodging-houses, rooms in which large families reside, workhouses, prisons, &c., and one particularly in the celebrated Black Hole at Calcutta, to need our saying more on this subject." How careful ought you to be that the rooms in which you sit, and particularly those in which you sleep, are not too tightly closed, or too long shut in! And how easy is it to raise a window, or to open a door! And though you might thereby be exposed to cold, (avoid, however, a draught,) yet how much more injurious on the whole, must it be to sit in close apartments, and continually to breathe a contaminated atmosphere! Remember, then, that air, which has been once breathed, may be considered as unfit for further respiration, and as totally spoiled for the purposes of animal life. The air is nowhere so wholesome as out of doors; and there, accordingly, every human being should spend, if possible, some portion of every day.

The entire quantity of blood in a full-grown person is estimated to be from twenty-four to thirty pounds.

The circulation of the blood was known, though imperfectly, by Plato, whose description is rather curious. "The heart," says he, "is the centre or knot of the blood-vessels; the spring or fountain of the blood, which is carried impetuously round. The blood is the *pabulum* or food of the flesh; and, for the purpose of nourishment, the body is laid out into canals, like those which are drawn through gardens, that the blood may be conveyed, as from a fountain, to every part of the pervious body." It is, however, to Dr. Harvey, an eminent physician, who lived under the reign of James I., that the world is indebted for a complete and accurate discovery of the circulation

* Combe's "Principles", &c., p. 211.

of the blood. Solomon seems to have known something of it, by his speaking of "the golden bowl being broken" at death, and "the pitcher broken at the fountain, and the wheel broken at the cistern."

The heart is kept in constant motion, we know not how, nor can the wisest anatomist in the world tell us. We know that the lungs have something to do in the case; and when once set a-going, we can form some idea of what keeps it in motion. Its motion can easily be felt by placing your hand on your left side. Palpitation of the heart is occasioned by violent action of the body, by fear, fright, or disease.

"How is the wisdom of the Creator displayed," says a distinguished anatomist, "in this constant action and preservation of the heart! One would think, from the complexity of this machine, and the delicacy of many of its parts, that it would always be liable to derangement, and that it would soon work and wear itself out. Yet it will go on night and day for fifty, seventy, or eighty years together, at the rate of one hundred thousand strokes every twenty-four hours, having at each stroke a great resistance to overcome, and will continue this for this length of time without disorder, cessation, or weariness."

The brief account I have now given you will not convey anything like a complete notion of the form, action, or the use of the heart, with the circulation of the blood; but enough has been said to give you some idea of "the wonderful mechanism bestowed on our frame, for the continuance of life, by the hand of a Being who is all-wise, all-powerful, and all-good, and whose bountiful care is equally extended to the preservation and happiness of the humblest creature in existence, which has been, equally with ourselves, called into life at his command, and for a wise and good purpose."

III.—THE LUNGS, WINDPIPE, AND EPIGLOTTIS

next claim our attention.

1. The Lungs, or *Lights*, as they are commonly called in the lower animals, from their spongy, light, cellular structure, are the organs of *respiration* or breathing. There are two of these organs in the chest, one on the right side, and the other on the left. Each of these divisions is formed into *lobes*, or large lumps, three belonging to the right lung, and two only to the left; the heart in the latter occupying the place of the corre-

sponding lobe on the opposite side. The letters in the wood-cut R L and L L, mark the right and left lungs, with the heart H lying between them, but chiefly on the left side. The lungs draw in and expel the air, and by these actions respiration is continually carried on. The lungs may be compared to a bellows or wind-chest in an organ, and blow their blasts at the rate of twenty or twenty-five in a minute, in an adult person; and at a still greater rate in children: and they continue these blasts, whether standing or sitting, sleeping or waking, as long as we live. The lungs are furnished with innumerable minute cells, the whole of which appear not unlike a honey-comb, or piece of sponge. They are of a light, elastic, spongy texture, being little else, indeed, than an interwoven series of air-tubes, air-cells, and blood-vessels. When we breathe out, or *expire*, all the air which is actually in the lungs is not expelled, but only a portion of it. Of course, when we draw in, or *inspire*, we merely introduce air in quantity sufficient to supply the place of that which is discharged.

It is well known that the commonest *Cough* has to do with the lungs, and it may be thus explained;—the lungs and lining membrane of the *Bronchi* secrete a certain degree of *mucus*, or phlegm. When cold or damp is applied to the skin, it sometimes occasions a mass of blood to be thrown inwards upon these surfaces or membranes of the lungs, which increases the secretion of the mucus to a high degree. "Were this secretion to accumulate, it would soon fill up the air-cells of the lungs, and cause suffocation; but to obviate this danger, the Creator has so constituted the lungs, that accumulated mucus or other foreign body coming in contact with them, excites the convulsive effort called *coughing*, by which a violent and rapid expiration takes place, with a force sufficient to hurry the mucus or other foreign body along with it; just as peas are discharged by boys with much force through short tubes by a sudden effort of blowing. Thus, a check given to perspiration, by diminishing the quantity of blood previously circulating in the surface, naturally leads very often to increased expectoration and cough, or, in other words, to common cold."*

Consumption is a disease seated in the lungs, often attended with hectic fever, cough, &c. In this disease *tubercles*, or small tumours, are found on the surface and substance of the lungs. These are discovered by percussion, or by the use of an

* Combe's "Principles of Physiology," p. 57.

instrument called the *Stethoscope*—a small wooden tube like a funnel,—one end of which is applied to the chest of the patient, and the other to the ear of the practitioner, by which he is enabled to hear whether the lungs are in healthy action or otherwise.

The action of the lungs is essential to life; for to *live* and to *breathe* are synonymous terms. Let the lungs have full play. The dress should not be so tight as to press closely on any part of the chest. To females we would say, Avoid, by all means, *tight lacing*. You may suppose that this improves the figure, but it only distorts it, and it is at the sacrifice of health, and sometimes even of life itself.

Next to the preservation of life, the most important use of respiration is that of forming the voice or speech. This is accomplished in part by

2. The WINDPIPE, or TRACHEA. This is a tube which extends from the mouth and nostrils down to the lungs. It passes down in front of the neck, where it may be easily seen and felt. It is made of gristle, and contains sixteen or eighteen rings. At its lower part it divides into two branches, one called *bronchus*, going to join the right section of the lungs, the other the left. The common disease called the *bronchitis* is an inflammation of the *bronchi*, or tubes which convey air to the lungs. The other malady, called the *Wen*, or *Bronchocele*, and by the French *Goître*, is a tumour lying on the *Trachea*. It is sometimes called the "Derbyshire neck." It is very common among the females of Switzerland. The upper part of the windpipe is called the LARYNX, which modulates the voice in speaking or singing. The larynx in men is larger than in women; hence the difference of voice in the sexes. Here the air from the mouth and nostrils is admitted. On the top of it is

3. The EPIGLOTTIS. This is attached to the root of the tongue. It is a sort of little tongue reversed, and acts like a trap-door on the windpipe; for it fits to the opening as exactly as a trap-door was ever fitted to its frame. "It is not often shut, however, except when we attempt to swallow. Then the substance, and the motion caused by this operation, press it down, and close it perfectly tight; and it is well that it is so; for if it were not, the food would often drop into the passage to which this trap-door opens, and create convulsive coughing, and probably disease and even death might ensue. How painful this is may be remembered from the irritation

which is felt when a crumb of bread, or drop of liquid may, as is commonly and truly said, 'go the wrong way.'"* Let young persons avoid holding pins, nails, buttons, and other such things in the mouth, as well as laughing and talking while eating; for it is at the least always dangerous, and may prove fatal.

There is another little tongue or flap, called the UVULA, attached to the roof of the soft palate, and seen above the arch of the tongue when the mouth is opened. It is peculiar to man, and the ape tribe: its use is to assist in speaking and swallowing. This, which guards the passage to the nose, is not, however, to be confounded with the other, which is further down the throat, and invisible.

The organs we have been just describing, viz., the Heart, Lungs, &c., are contained in the upper portion of the trunk of the human body, called the *Thorax* (from Θωραξ, a coat of mail), or *Chest*. This is enclosed by the ribs, having the sternum or breast-bone in the front, and a portion of the bones of the back behind. It is separated from the liver, stomach, intestines, &c., by

IV.—THE DIAPHRAGM.

This word is derived from the Greek Δια, through, and φραγμα, an enclosure. It is vulgarly called the *Midriff*. It is a strong skinny muscle, or fleshy partition, spreading in an arch-like form under the heart and lungs, and over the liver, stomach, and bowels. (See fig. D D.) It is greatly concerned in the act of respiration, as it rises and sinks as we breathe. The acts of coughing, sneezing, speaking, laughing, gaping, and sighing, could not take place without its assistance.

The lower part of the body, under the diaphragm, is called the ABDOMEN.

V.—THE STOMACH, AND GASTRIC JUICE

must now be noticed.

1. The STOMACH. (See fig. *Stm.*) This is an oval bag of considerable size, occupying a slanting position immediately below the heart, with its right side overlapped by the left edge of the liver, and extending to the lower end of the breast bone. In figure, it nearly resembles the pouch of a bagpipe, varying in its capacity from five to eleven pints. It has two openings,

* "House I Live in," p. 149.

both on its upper part;—the left, called the CARDIA, is that through which food and drink pass down from the mouth by the ŒSOPHAGUS, or *gullet*, or food-pipe;—the right, called the PYLORUS, is that through which the aliment, when it is digested, is conveyed out of the stomach into the intestines, or bowels. The first bowel is called the DUODENUM, (so named in consequence of its length being twelve inches), in which the aliment undergoes other changes. The stomach is a remarkable vessel, or bag, the functions of which are not easily explained or understood. Dr. Hunter, in one of his Lectures to his medical students, said, "Some physiologists will have it that the stomach is a *mill;* others, that it is a *fermenting-vat;* others again, that it is a *stew-pan;* but in my view of the matter, it is neither a mill, nor a fermenting vat, nor a stew-pan;—but a stomach, gentlemen, a *stomach.*"

This organ secretes a peculiar fluid named

2. The GASTRIC JUICE, so called from Γαστηρ, the stomach. This is clear and colourless, with little taste or smell; it is something like saliva or rennet. It seems to ooze out from the inside coats of the stomach like drops of sweat. It is a very powerful solvent, dissolving bone, and very hard substances: it has been known, after the death of a person, to eat into holes the stomach itself, if food has recently been eaten; for it is food that stimulates the juice, as salt in the mouth will stimulate saliva. "The contact of solid food with the inside of the stomach," says Dr. Carpenter, "is the proper excitement to the secretion of the gastric fluid. Soups and such like are not alone fit for the support of the system, even though they may contain a large amount of nutritious matter. The Greenlanders, it is said, mix earth or saw-dust with the train-oil, on which alone they are frequently reduced to live. One of them being asked the reason of the practice, replied, 'I cannot tell you, but I know the belly must be filled.' The gastric juice, when poured upon the food, is thoroughly mixed up with it by a peculiar action of the stomach, which is continually bringing into contact with its sides, fresh portions of the alimentary mass, so that the whole is, after a time, equally exposed to the influence of the fluid. If this movement were not to take place, only the outside of the mass would be digested, and the central portion would remain but little affected. . . . . It is a fact of great practical importance that a certain quantity of the gastric juice can act only upon a limited amount of food; so that if more food be swallowed than is required to repair the

waste of the body, it lies for a time unchanged in the stomach, and becomes a source of irritation, which prevents the due discharge of its functions. This may not be *felt* by the individual at the time; but it leaves permanent effects, which manifest themselves, sooner or later, in derangement of the general health."*

We are now naturally led to treat of the subject of

VI.—DIGESTION.

This is one of the most important operations in the animal economy. It is by this, the various substances used for food are dissolved in the stomach, and undergo changes, by which they are formed into matter fit for entering into the composition of the different parts of the body, to nourish its growth, and supply the daily waste which takes place in the system. By this waste, it is supposed that the body of an adult person changes its whole materials many hundred times from the period of its birth till death; and that an individual, as regards his mere corporeal structure, is not at all the same at the period of manhood, as he was when a boy; nor in old age, as he was in his prime. This change, however, is so gradual, that it is never perceptible.

"In early life, during the period of growth, the amount of substances received into the body is greater than that which is lost. At a later period, when growth is completed, an equilibrium between the matters received and those rejected is established. At a still later period, the equilibrium is again disturbed, more is rejected than is retained; decrepitude begins, and at last the organism becomes exhausted, the functions cease, and death ensues."†

Man has been called, with relation to his diet, *omniverous*, from his being adapted to live on every kind of food. *Carnivorous* animals live on flesh alone; *graminivorous*, on grass and green herbs; and *granivorous*, on grains and other smaller seeds. But man was intended to feed on every sort of food. Man also differs from brutes in resorting to the art of cooking, by which the food is put into a state more fitted for digestion and nourishment.

The food, being received into the mouth, is broken to pieces by the teeth, reduced into a soft pulp by the saliva, and

* Dr. Carpenter's "Animal Physiology," p. 168.

† Agassiz' and Gould's "Comparative Physiology," p. 169.

then, by the act of swallowing, passes into the stomach, where, in a short time, it is reduced to a thin greyish paste called CHYME. It is then slowly conveyed to an outlet named the PYLORUS, from the Latin word *Pyla*, a gate, or post;—by which term is meant the door or outer-gate of the stomach; or, as some call it, the door-keeper. "If anything from the stomach present itself there, which is not proper to be conveyed into the system, or not well adapted for making blood, it does not, for some time, suffer it to pass; though after the substance has repeated its efforts many times, it appears to yield, as if to importunity. True *chyme*, made of good and proper materials, it never refuses, but suffers it at once to pass into the duodenum."* So faithfully does this guardian perform its office, that it will often contract with so much violence when undigested food is presented to it, as to produce severe pain,—the pain which children, after eating unripe fruit, call "the belly-ache,"—and force the stomach to reject the offending matter by vomiting, rather than allow it to pass in an unfit state; whereas, when chyme duly prepared presents itself, it readily opens a passage for it into the duodenum. There it is mixed with a bitter fluid, secreted by the liver, and coming from the *gall-bladder*, called *bile;* and with another fluid secreted from the PANCREAS,† termed the *pancreatic juice*. It is then changed into a milky fluid called CHYLE, and this chyle is taken up and carried into the blood by means of very minute vessels, called *lymphatic* vessels, or *lacteals*, and constitutes the proper nutritive substance. There is, however, a refuse matter left, which is conveyed through the intestines, out of the system. It has been asserted that the bile tends to promote digestion. It is certain, however, that it has nothing to do with the *first* stage of digestion carried on in the stomach: but in the *second*, viz., in the duodenum,—into which the pancreatic juice also flows,—a further sort of digestive elaboration takes place, in order to accomplish the functions of nutrition, assimilation, and secretion. If it had been the office of the bile, in the first instance, to promote digestion, it would have been emptied at once into the stomach, and not into the duodenum. "But so far from its promoting digestion, the presence of it in the stomach never fails to disorder that organ, so as to excite nausea, and often violent vomiting. During that operation, the liver

* "House I Live in," p. 175.

† The Pancreas of a beast is generally called the *sweet-bread*, and is shaped like a dog's tongue.

being compressed by the action of certain muscles in the lower belly, a quantity of the bile is forced into the intestines, and from thence into the stomach, which, on being brought up, the patient is led to suppose was in the stomach prior to the sickness. The matter, however, *first* vomited up, being evidently *acid*, is a proof that there was previously no bile in the stomach. The bile is also the *last* thing ejected."*

The length of the intestines is generally six times the length of the whole human body; and by being variously twisted and turned, they are fitted for their receptacle. (Fig. 111.) They have a peculiar motion, called by some *vermicular*, as the worm, in moving along, contracts its body, and then propels itself forward; and by others, *peristaltic*, which is, I presume, something like the motion of the grub or silk-worm. This contraction always takes place slowly; it may be hastened, however, by the action of certain stimulants, such as mercury, senna, magnesia, brown bread, &c.

I need not say how needful to health is a good digestion; and how important it is that you should be careful as to the quantity and quality of the food you eat. If digestion is going on properly, you will be unconscious of it. Indeed, no one should know that he *has* a stomach. Food remains in the stomach upwards of an hour before any change in it becomes perceptible. A meal is supposed to be completely digested in the human stomach in about four or five hours. Rest is well known to be favourable to the process of digestion; though a moderate degree of exertion, after a moderate meal, will not interfere in persons of good health. From this, we may see the wisdom of the old proverb, "After dinner sit awhile." A gentleman once took two pointer dogs of nearly equal strength. Having given them both a full meal, he left one at rest, and took the other out coursing. At the end of two hours, he had them both killed, and found, in the dog that had remained at home, all the food *chymified*, i. e. put through the first stage of digestion; while in the stomach of the other dog the food remained almost in the same state as when swallowed.

Exercise *immediately before meals*, unless of a very gentle description, is injurious; and an interval of rest ought always to intervene. It is a rule in the management of horses never to feed them immediately after hard work, but to allow them

* Recce's "Medical Guide," p. 206.

an interval of rest proportionate to the previous labour. A mere stroll, which requires no exertion, and does not fatigue, will not be injurious before or after eating; but exercise beyond this limit is at such times hurtful.

During digestion, both apertures of the stomach are closed; the vital powers seem to leave the surface of the body, and concentrate themselves on the important work that is going on. There is, therefore, a slight chill on the surface of the body; and after dinner, in the cold season, every one naturally draws round the fire: and here we are reminded of another old proverb,—"Eat till you're cold, and live till you're old."

We call your attention, lastly, to

VIII.—THE LIVER AND OTHER VISCERA.

1. The LIVER is the largest and heaviest gland in the body; (see fig. LIVR.); it is so disproportionate to the quantity of liquid secreted, that the bile must require a very extensive apparatus for its elaboration or production. It weighs, in adults, about three pounds. The colour of the liver is of a dusky or brown red. It is situated under the diaphragm, inclining to the right side of the body, having the stomach beneath it; between which and the liver itself lies the *gall-bladder*, which is about the size of a man's thumb. The liver is divided into two principal lobes, or lumps, the right of which is by far the largest. One principal use of the liver is the secretion of bile, of which the gall-bladder is the receptacle. It also contributes materially to the purification of the blood. The *bile* is of a yellow green colour; and its taste exceedingly bitter: hence the figurative expressions,—"to stir up one's bile,"—"as bitter as gall." The use of the bile appears to be to assist in separating the chyle from the chyme, and to excite the intestines to action. The liver is often subject to disease, producing jaundice and bilious complaints. These commonly arise from sedentary habits; improper food and drink, as to quality and quantity; undue anxiety of mind, or irritability and fretfulness. The best remedies are—early rising; bathing; out-door exercise; temperance; patience; and good temper.

2. There are in the human frame, numerous GLANDS, which are clusters, or soft round bodies, of various sizes, composed of blood, and vessels, and nerves, united together in different folds. Their office is to secrete or separate from the blood

certain fluids which they discharge either immediately, or by other vessels termed *excretory*.

The KIDNEYS are two of the largest glands. These are situated in the loins, one on each side of the back bone, upon the two last ribs, i. e. about one-third up the spine; the left is higher up than the right, and generally larger. They are, in shape, like a French bean. Their use is to filter or separate from the blood the superabundant fluid, and salts and juices unnecessary for the system; and transmit these, by means of two small tubes (from the middle of the kidneys), called the *ureters*, to the *bladder*. The kidneys are generally enveloped on all sides by a thick mass of fat.

The smaller glands are those of the eye, producing *tears;* of the ear, *wax;* of the nose and throat, *mucus;* of the mouth, *saliva;* of the joints, *synovia*. There are glands under the skin, producing *sweat;* and in the breast, producing *milk*. Those little swellings which sometimes appear, and are felt in the side of the neck, and just under the ear, and which are called *kernels*, are inflamed glands.

The reflections that naturally arise from the consideration of the structure of the human frame, are, that we are indeed "fearfully and wonderfully made;" and that some superior Intelligence must have presided over the formation of so wonderful a machine, whose creatures we consequently are, and whose laws we are bound to obey. The benevolence of God is especially displayed in its construction. "If he had wished our misery," says Paley, "he might have made sure of his purpose, by forming our senses to be so many sores and pains to us, as they are now instruments of gratification and enjoyment. He might have made, for example, everything we tasted, bitter; everything we saw, loathsome; everything we touched, a sting; every smell, a stench; and every sound a discord. . . . . Contrivance proves design: and the predominant tendency of the contrivance indicates the disposition of the designer. Evil, no doubt, exists; but is never, that we can perceive, the object of contrivance. Teeth are contrived to eat, not to ache; their aching now and then, is incidental to the contrivance, perhaps inseparable from it: or even, if you will, let it be called a defect in the contrivance; but it is not the *object* of it. This is a distinction which well deserves to be attended to. . . . . No anatomist ever discovered a system of organization calculated to produce pain and disease; or, in explaining the parts of the human body, ever said, This is to irritate; this to inflame, &c."

THIRD LECTURE.

Our present Lecture will be on

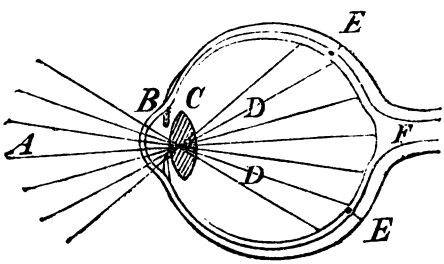
THE FIVE SENSES,

including a reference to those organs of the human body through which those senses operate.

Although the Senses, properly speaking, are, like the Soul, immaterial, that is, not consisting of substance or matter, but of sensations excited in the mind by external objects, and in this respect not proper subjects of anatomy; yet as all their *organs* are material, they constitute a proper and important branch of anatomical knowledge. The number and names of the Senses are the five following:—Seeing,—Hearing,—Smelling,—Tasting,—and Feeling. These comprehend our whole sources of sensation and knowledge. Without them the mind could have no ideas. The great end of the Senses is to make us acquainted with external objects and their qualities, and our perception of these is accompanied with a belief that they exist, and are what they appear to be.

We commence with

I.—THE EYE, which is the Organ of *Seeing*.



A.—Rays of light from all parts. *B*.—Cornea, through which they pass. *C*.—Crystalline lens, where they are refracted. *D D*.—Divergent rays. *E E*.—Retina, upon which the picture is formed. *F*.—Optic nerve.

The Eye is a most beautiful and ingeniously constructed object. It may be compared, in its structure, to a telescope, the purpose of both being to collect the rays of light proceeding from the surface of bodies, and to bring those rays to a common centre, by means of a peculiar *lens*, or glass, into a *focus*, or given point; and thus to form a very fine image or picture of the object before them.

The Eye may be said to consist of two parts,—the internal and the external, or the Eye itself, and that which surrounds it. The eyes are situated in two bony cavities, or sockets, named *orbits*, in which they move, and by which they are protected. These orbits have their vacant spaces filled with a loose soft fat, which serves as a proper bed for the eyes to move or rest in. In human beings the eyes are not fixed, like those of some animals; but, by means of six different muscles, can be made to roll about, upwards, downwards, and sideways; and thus we are spared the trouble of turning our heads continually towards the objects we wish to inspect. By these contrivances, the eye, as a natural telescope and microscope, is made to advance, to recede, to move to the right and to the left, and in other directions; and to view near and distant objects with equal distinctness; so that a single eye, by the variety of positions it may assume, performs the office of a thousand. Flies and other insects, whose eyes are immoveable, have several thousands of distinct globes in each eye. In one of the eyes of the common dragon-fly there have been reckoned thirteen thousand five hundred of these lenses; and consequently, in both eyes, twenty-seven thousand, every one of which is capable of forming a distinct image of any object.

The eye itself is a small round ball, covered, for the most part, with three membranes or skins, lying one upon another, something like the rind and the white inner skin of an orange. The first or outer coat, that is, the white of the eye, is called the SCLEROTICA, from its being hard, firm, tough, and opaque, or not transparent. The second under coat is termed the CHOROID. This is a thin, delicate skin; one part of which is filled with a black matter, called *pigment*, or paint, designed to soften or absorb the rays of light after they have passed the third inner membrane, called the RETINA (fig. E E), which we shall presently describe. The greater cavity of the ball of the eye is filled with a fluid, named the VITREOUS HUMOUR, so called, as it resembles melted glass. It is something like the white of an egg. This keeps the ball distended, and preserves its round form.

As you look at your own eye in the looking-glass, or inspect the eye of another, you will perceive, in the centre, a small, dark, round spot. This is the PUPIL, or apple of the eye. Sometimes the pupil is circular, as in man, the dog, the monkey; sometimes in an upright oval form, as in the cat; or in a horizontal oval form, as in the sheep. It is the opening through which the rays of light pass to the retina, (fig. E E,) one of the inner coats of the eye, resembling fine net-work;—*retina* signifying a net; which is an expansion or enlargement of a nerve at the back part of the eye, called the OPTIC NERVE, (fig. F,) which extends to the brain. The retina is something like a mirror, upon which the objects we see are received or painted. Thus a landscape of many miles in extent, with all its hills, valleys, and plains, trees, flowers, rivers, houses, &c., may be painted upon a space of less than an inch diameter, or the size of a sixpence. Thus the little retina takes portraits of all comers. All creation sits to this silent diminutive artist. Around the small pupil there is, you will perceive, a coloured circle, called the IRIS, or rainbow, from its variegated colours. These colours are in some eyes black, in some brown, in some blue, in some grey. The iris is a membrane resembling a round moveable curtain, designed to regulate the volume of light admitted through the pupil of the eye. The pupil varies in size according to the degree of light to which the eye is exposed. It becomes smaller when the eye is subjected to a strong light; and enlarges when the light is more obscure. You have seen the eye of a cat, when she has been sitting before the fire, or in the sun; the pupil is then contracted almost to a straight line: the same may be said of the owl. So by holding a candle before the eye of a person, you will see the pupil contract or expand according to the distance and strength of the light. When we are in the dark, the pupil becomes very large, (almost as large as the iris,) in order to admit as many rays of light as possible to pass through to the retina. In the front and outside of the iris and pupil of the eye is a transparent membrane called the CORNEA, (fig. B.) It is a horny substance, and hence its name, (from the Latin word *Cornu*, a horn.) It projects a little in front of the ball of the eye, something like a watch-glass. Through this, the rays of light (fig. A,) pass to the pupil. The cornea, by age, undergoes several changes. As individuals advance in life, the texture or substance of the cornea becomes more thick and tough than previously. It also becomes flattened, and people require the use of spectacles, to make a sort of artificial cornea.

Just behind the pupil of the eye, and further into the ball, is the CRYSTALLINE LENS, (fig. C,) that is, a firm substance of a jelly-like nature, as clear and transparent as the brightest, purest, crystal. It is in a *double convex* form, like two watch glasses, put together at their rims or edges. It is about the size of a small damson stone, or the kernel of a hazel nut. This lens serves to refract or break the natural course of the rays of light, (fig. D D,) as they pass through the cornea and the pupil to the retina, and form a perfect image thereon. There is a disease of the eye, called *Cataract*, in which the crystalline lens becomes dim and dark,—losing its transparency; and as the rays of light can no longer pass through it, the individual so affected becomes blind. An effectual remedy for this complaint is the removal of the lens from its situation, either by pushing it downwards below the pupil; or, by cutting the side of the eye, and squeezing it, and then pushing the lens out of the eye altogether. Even after this is gone, a person may have his sight, though imperfectly, as the light would still pass through the pupil to the retina. This operation can be performed only by the skilful surgeon; and in some instances it occasions but little pain to the subject of it. An experiment of this kind may be easily made by any one. Take a recently dead sheep's eye, and with a lancet or pen knife cut horizontally the cornea: the aqueous humour will at once spurt out. Then squeeze the ball of the eye, and the crystalline lens will come forth,—a beautifully transparent object! On a further incision of the lancet, the vitreous humour will all ooze out, and the eye-ball will collapse or shrivel up, and the retina and black pigment appear. In the space between the cornea and the crystalline lens, there is a transparent fluid, called the AQUEOUS or watery HUMOUR; and between the crystalline lens and the retina is the vitreous humour, which we just now said nearly fills the middle of the eye-ball, and preserves its round shape. The exercise of seeing, then, may be thus further described:—"The rays of light (fig. A), entering from all directions, in passing through the eye, strike first upon the cornea (fig. B), then pass through the aqueous humour, and enter the crystalline lens (fig. C): having arrived there, the rays diverge (fig. D D), or separate, as from a centre, towards the internal circumference, and traversing the vitreous humour, impinge, or strike upon, all parts of the retina (fig. E E); and it is here,—upon the retina,—that the phenomenon understood by the word *sight*, is effected." If we take a bullock's eye, and cut

off the three coats from the back part, and put a piece of thin white paper over that part, and hold the eye towards the window, or any bright object, we shall see the image of the object depicted upon the paper, in an inverted position: for "there is a curious circumstance connected with this operation of vision; which is, that the image or picture, in front of the eye, is formed on the retina in an *inverted* position; or, as we should say, upside down. Thus, if I am looking at a horse or a tree, there is a kind of image, or shadow of that horse, or tree, on the retina of my eye, with its lowest part upwards. Why everything seen by the eye does not appear inverted, rather than in its true position, is not known, though many very ingenious theories have been invented to account for it."*

The ball of the eye is filled with various beautiful blood-vessels. In a diseased state, and when inflamed, these vessels are distinctly seen, in what is called a *blood-shot* eye. Within the orbit, above each inner corner of the eye, there is a gland called the LACHRYMAL GLAND, (from *lachryma*, a tear,) which secretes the watery fluid called *tears*, and keeps the eye moist, and clean, and clear. It assists the motion of the eye-ball and eye-lids, and preserves the eye from the contact of the atmosphere. At the corner of each eye-lid, near the nose, is a small tube or pipe, about the size of a crow quill, which conveys the water of the eye to the nose. When once the fluid has entered there, it spreads itself upon the inside of the nostrils, and is evaporated by the current of warm air, which, in the course of respiration, is continually passing over it. By strong emotions of the mind, however, this liquid overflows the lower eyelids in tears. How grief or joy excites the lachrymal gland, so as to produce these tears, we know not. Here I quote, from the "Family Friend," a few sentences on "the Philosophy of a Tear."

"Beautiful Tear! whether lingering upon the brink of the eyelid, or darting down the furrows of the care-worn cheek—thou art beautiful in thy simplicity—great, because of thy modesty—strong, from thy very weakness. Offspring of sorrow! who will not own thy claim to sympathy? who can resist thy eloquence? who can deny mercy when thou pleadest? Beautiful Tear! . . . . It is only when the crystal drop comes forth under the impulse of sorrow—thus speaking the anguish of the mind—that it can properly be called a *tear*.

* "House I Live in," p. 121.

Hence its sacred character, and the sympathy which it seldom fails to create. . . . . Whenever we behold a tear, let our kindliest sympathies awake—let it have a sacred claim upon all that we can do to succour and comfort under affliction. What rivers of tears have flown, excited by the cruel and perverse ways of man! War has spread its carnage and desolation; and the eyes of widows and orphans have been suffused with tears. Intemperance has blighted the homes of millions, and weeping and wailing have been incessant. A thousand other evils which we may conquer have given birth to tears enough to constitute a flood—a great tide of grief. Suppose we prize this little philosophy; *and each one determine never to excite a tear in another*—how pleasantly will fare mankind! . . . . And let all our efforts be devoted to the substitution of smiles for tears."*

The *eyelids* deserve attention. These are a thin membrane which drop down and are lifted up almost every moment, in the act of winking. They defend the eye; wipe it; and close it in sleep. "One of their uses is to regulate the strong light of the sun when too powerful. If the eyelids were cut off, we should most probably soon become blind. Those people who are in the habit of allowing the full blaze of a lamp, or a bright fire, to shine for a long time in their eyes, run a great risk of doing injury to their sight." Birds and most reptiles have two eyelids. In fishes, the lids are wanting, or immoveable. When the eyelids are closed, the skin is quite smooth; but when they are open, it forms itself into folds and wrinkles, more particularly in elderly persons. There are two exquisitely fine muscles by which the eyelids are enabled to open and shut. Paley speaks of a certain gentleman, who, though as to the rest of his body, was in good health, yet only wanted the use of these two muscles: by this deficiency he had almost lost his sight, being forced, as long as the defect lasted, to raise up his eyelids, whenever he wished to see, *with his own hands!* We are here reminded of the well known lines of Watts,—

> "Our life contains a thousand springs,
> And dies if one be gone;
> Strange, that a harp of thousand strings
> Should keep in tune so long!"

The *eyelashes*, while they add to the beauty of the eye, prevent superfluous light, floating particles of dust, insects, &c., from

* "Family Friend," vol. 1, p. 38.

getting into it. At the roots of the hairs of the eyelashes there are glands which produce a gluey substance. In disease the eyelids sometimes become glued to each other.

The *eyebrows* are peculiar to the human species. They are intended both for ornament and utility. This beautiful arch of hair affords a shelter to the eyes, like a thatched penthouse preventing the sweat and moisture of the forehead from running down into them. They also assist in giving expression to the passions of the mind. They are lifted up when surprise is felt, or complacency expressed;—contracted and knitted into an awful frown to denote anger and indignation.

The eyes, then, are the organs of sight; and "sight is the sense by which light is perceived, and by means of which, the outlines, dimensions, relative position, colour, and brilliancy of objects are discerned. Some of these properties may be also ascertained, though in a less perfect manner, by the sense of touch. We may obtain an idea of the size and shape of an object, by handling it; but the properties that have a relation to light, such as colour and brilliancy, and also the form and size of bodies that are beyond our reach, can be recognized by sight only."* How wisely and how beautifully are the eyes adapted for the purpose of sight! They are so constructed as to allow us to see things near, or at a distance; to confine ourselves to the inspection of one object, or to take in at once a larger sphere of vision. Of all the senses, that of sight is in most frequent and continual exercise. It fills the mind with the greatest variety of ideas, which it gathers not only from the objects of nature and of art, but from the writings of the wise and good of all ages. The eye, as Dr. Young says,

> "Takes in, at once, the landscape of the world
> At a small inlet which a grain might close,
> And half creates the wondrous world we see.
> But for the magic organ's powerful charm,
> Earth were a rude, uncolour'd chaos still."

It has been well observed that "the examination of the eye is a cure for atheism." Who does not see and admire the wisdom, and skill, and goodness of the Creator, in its formation, and in its perfect adaptation to its purpose? What care has been taken to guard this delicate and invaluable organ from injury! "Observe its situation—placed in a deep bony

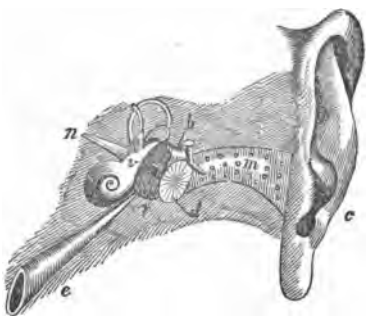
* Agassiz' and Gould's "Comparative Physiology," p. 58.

socket—at once adorned and protected by its eyebrows, eyelashes, and eyelids! Fixed in front of the head, it commands an extensive range over the whole face of created things. It equally surveys the boundless profusion of the earth, and the spacious magnificence of the heavens; and, comprehending all things, it, as has been elegantly expressed,

'Looks up through nature unto nature's God.'"*

We now come to

II.—THE EAR, which is the organ of *Hearing*.



The Ear, like the eye, consists of two parts, the external and the internal. The *external* human ear, called by anatomists, the CONCHA, (fig. *c*,) from the shell-fish named the *muscle*, which, in form, it resembles, is, in its natural shape, and when well formed, one of the most ornamental, as well as useful parts of the bodily frame. It is not elongated, like that of many other animals, especially of one I need not name; nor flapping down like that of others; but sits open and close to the side of the head. It is of a cartilaginous or gristly substance, and covered with a delicate skin. It is well adapted to collect and receive sounds, being like a funnel, and having various windings and channels in it to transmit those sounds into the internal ear. It is attached by ligaments and muscles to what is called the *temporal* bone of the head. If the ear were cut off, it would not only greatly disfigure the head, but

* "House I Live in," p. 127.

the sense of hearing would be impaired, and the internal part of the ear more exposed to injury. Man, at least in his civilized state, does not move his ears,—pointing them forward, pricking them upward, or turning them backward, like the horse, the dog, the cat, the hare, and other animals. Persons whose hearing is deficient employ an artificial concha, or trumpet, by which they collect vibrations of sound from a more extended surface.

The *internal* part of the ear consists of numerous circular and winding passages, cavities, labyrinths, bones, and nerves, which I will endeavour to describe.

The first passage into the ear is called the *auditory canal*, (fig. *m*), or passage of the ear. It is of an oval shape, with a slight curve, and a little more than an inch in length. It is about the size of a goose-quill; and is lined with a fine sensitive membrane. At its entrance there are usually a few small fine hairs growing. These prevent dust and flies from entering in, as well as tend to moderate sound. Then there is a substance called CERUMEN, or *wax*, originally fluid, but by exposure to the air becomes of a consistency like paste, of a deep yellow colour, and of a very bitter taste. This also is of the same use as that of the hairs—serving to entangle any insects that might otherwise get into the ear; but indeed this seldom happens, as its bitterness would prevent them. There is an insect called the *ear-wig*, a name given from the notion that these animals creep into the ear, and cause injury; but such cases are very rare. Sometimes the wax, being produced in too great quantities, fills up the passage, and causes deafness.

At the further end of the first passage of the ear lies a thin membrane called the TYMPANUM (fig. *t d*), the Latin word for a *drum*, which it resembles. It is about half an inch in width, stretched upon a bony ridge, almost circular, like the pelt of a drum on a drum-head. This is commonly called "the drum of the ear." It is almost transparent, and sufficiently lax to tremble with every breath of air. Its position is nearly horizontal, sloping at the end of the passage, which appears to be the best position for receiving sounds. This drum, by its vibrations,—occasioned by sound striking on it, as you produce tremulous motions by striking with a stick or a stone a sheet of water, or the pelt of a common drum,—conveys, through the medium of the nerves, the sensations of sound to the brain. Connected with the tympanum are four small bones (fig. *b*),—the smallest, the most curious, and the hardest bones in the body—

almost as hard as ivory. They are arranged in the following order:—there is "first, a hammer-shaped instrument, called the MALLEUS, or *mallet*, whose handle is attached to the tympanum. The head of this hammer rests upon an *anvil*, the INCUS; and the anvil in turn is secured, through the medium of a small bone, called the Os ORBICULARE, (or round bone,) to a peculiar instrument shaped like a *stirrup*, and called the STAPES, . . . and as the base of the latter is affixed to an internal membrane called the FENESTRA, or window, this ivory apparatus, comprehending the four implements we have mentioned, appears to be strung right across the cavern of the ear, and so forms a solid chain of communication between the external tunnel and the internal cavity, which lies beyond. . . . This interior cavity, which is very appropriately designated the LABYRINTH, from its intricate construction, contains three portions,—namely, the VESTIBULE, (fig. *v*), and the three semi-circular canals, and the COCHLEA,—the latter a very remarkable spiral organ winding round a central pillar, and bearing no inapt resemblance to the shell of a garden snail. It is in this curious cavern that the AUDITORY NERVE (fig. *n*,) gives off numerous fine filaments [or threads,] and conveys the various sounds as they arrive to the brain, and lays its message before the mind."*

I find it exceedingly difficult to understand and to explain exactly and clearly the structure and functions of the ear; for of all the complicated machinery which is contained in the human body, none is more apparently intricate, and more difficult to comprehend, than the various parts of this acoustic organ. But He who "planted the ear,"—who made the ear for sound,—contrived all parts of it for some office; and we must believe that every part of it is necessary to the sense of hearing.

Behind the cavity or hollow of the tympanum, there is a passage which leads from the ear to the back part of the mouth. It is called the EUSTACHIAN TUBE, (fig. *e*), from Eustachius, the name of its discoverer. It is about an inch and a half in length. In its structure it is something like a trumpet, narrow towards the ear, and of greater width towards the mouth. The design of this tube is most probably the same as the hole in the common drum, to allow the air to escape from behind, and thus promote the vibration of the membrane of the tympanum; for it is found that if such a hole is not made in a drum,

* Article in British Quarterly Review, on "the Philosophy of the Senses," April, 1854.

little or no sound will be produced: and in the human ear, when this tube is choked up by the inflammation of a common cold, deafness is occasioned. The vestibule, or porch of the ear, is covered over by a thin membrane, on which the nerves of hearing are expanded, and convey the sensations of sound to the brain, by the auditory nerve. This nerve bears the same relation to the organ of hearing, as the optic nerve does to the eye. Both may be considered as the principal part of the apparatus, to which all the others are subservient. Besides these contents of the labyrinth, a small quantity of watery fluid is found, sufficient to keep all the parts of this involved structure constantly filled; and which fluid is of the same nature as the aqueous humour of the eye.

We will just briefly recapitulate the outlines of what we have said on the structure and economy of the ear. First, then, the sound is collected by the concha, or outer ear, and is transmitted by the auditory canal to the tympanum;—striking upon this drum, it is conveyed along the chain of bones we have been describing, agitating the liquid contained within the labyrinth, and thus acting upon the auditory nerve which is distributed throughout the whole extent of the canals, the vestibule, and the cochlea. This agitation of the fluid within the labyrinth, greater or less, according to the degree of sound admitted, excites the peculiar action of the auditory nerve, and the sense of hearing is the result.

Sound is a peculiar agitation of the air, and this agitation acts upon the tympanum in the same manner as it is often found, when cannon are fired, to act upon the windows of a house; that is to say, it shakes the tympanum, the nerve of which conveys a report of every definite peculiarity of the impression made upon it to the brain. The small cells in the labyrinth, of which we have spoken, are supposed to reverberate the sound, and heighten the impression carried by the nerve to the great centre of perception—the mind. Sounds are of various kinds;—the shrill, the deep, the grating, the harsh, the loud, the soft, the harmonious, the sweet. Animals produce different sounds. The cat mews, the dog barks, the lion roars, the ass brays, the cow lows, the horse neighs, the rook caws, the goose cackles, the cock crows, the fly buzzes, the bee hums. Man, by imitation, can produce all these sounds; but he also speaks, laughs, cries, shouts, groans, whistles, sings; and, by the use of wind and stringed instruments, he can call forth every kind of sound which the air by

its vibrations is capable of producing. Now the ear is the medium through which all sensations of sound reach the mind. Without it, we should be deprived of the advantages of verbal instruction, the pleasures of conversation, and the charms of music.

"How much do we perceive in the wonderful construction and contrivance of the ear to evince the consummate wisdom, as well as the beneficent intentions of the Almighty! How complicated a structure, and yet how admirably adapted to its end! How carefully guarded, too, is this tender organ,—deeply imbedded in the substance of the hardest bone, yet penetrable to the slightest whisper—adapting itself with admirable facility to the loudest thunder, or the roaring of artillery,—to the softest breathings of music, or the tenderest utterances of affection."

III.—THE NOSE is the organ of *Smelling*.

This is the most prominent feature of the countenance. On man, it is situated near the middle of the face; but in quadrupeds, it is at or near the lower extremities of the head. There are great varieties in the form of the human nose. Some are long and straight; some short and dumpy; some rather crooked; some rather flat, with nostrils large and wide. The nose has had different names given to it, according to its shape, such as the Roman nose; the Pug nose; and the Aquiline nose; the last resembling the beak of an eagle. The beauty of the human face is greatly regulated by the form of this member. It is also a distinguishing feature of personal identity. People are recognised by their noses sooner than by any other feature of the countenance.*

This organ is constructed of a number of very thin bones coming out of the skull, covered with a soft membrane, upon which the branches of the nerves of smell are minutely spread. The outer and lower part of the nose consists of cartilage or gristle. It is divided, lengthwise, by a portion of thin bone, carried on by a thin piece of gristle running down the centre, forming two passages, called the nostrils. These nostrils, at the inner and back parts, communicate with the throat, to which there is a free passage. The whole external surface of

* The portraits of the late Duke of Wellington are at once known by his prominent aquiline nose; and those of Lord Brougham, by a nose curled or turned up, rather swelling at its extreme point.

the nose is covered, like the ear, with a soft, thin, smooth skin. At the entrance of the nostrils small fine hairs are usually found. These are designed, like those of the ear, to keep out dust, flies, &c., as well as to regulate the sense of smelling; and also to prevent the *mucus*, or thick fluid of the nose, from constantly flowing. The inside of the nose is lined by a fine skin, called the MUCOUS MEMBRANE, which is full of vessels and nerves, and is the principal organ of smelling. It is constantly preserved in a proper degree of moisture by the mucus of the nose, which is made and discharged by the mucous glands. This defends the nerves,—which are almost naked,—from the air which is respired. By this also the nerves are freed from pain; but by becoming *acrid*, or sharp, or pungent, this mucus irritates the nerves, and excites sneezing for its removal. It is accumulated during the night in sleep; but in the day, it either flows spontaneously, or may be more powerfully expelled by blowing the nose. The tears from the eyes descend by a small tube, (as already noticed), into the nose, by which they moisten and dilute or liquify the mucus.

The uses of the nose are chiefly for smelling; respiration; speaking and singing.

1. Though the sense of *smelling* is not so important to man as the other senses, it adds much to his pleasure, and answers some useful purposes. The air is filled with minute and often invisible particles which come from most if not all bodies around us; from flowers and plants, and vegetable and animal substances; especially from diseased and putrifying animals. Now the air, containing these particles, is, by the power of inspiration, or inward breathing, drawn through the nostrils, and applied to the nerves, called the OLFACTORY NERVES, which have a connection with the brain. Hence the sensation termed *smelling* is excited. "Such is the subtile state of division wherein matter may exist, that a single grain of musk has been preserved in an apartment for ten years; and though doors and windows were frequently opened, and the air repeatedly changed, yet the room was kept constantly charged with the odour; nor could it be discovered, at the end of this time, that the musk had lost the slightest portion of its weight. What, then, must be the extreme divisibility of its substance, and what must be the delicacy of the organ which can at all times recognise the presence of such infinitesimal particles!"* In smelling, a stream

* "Philosophy of the Senses."—Brit. Quar. Rev.

or current of air must pass in through the nose, before the odour is perceptible. If the air is perfectly still, and no current allowed in the nose, by suspending or stopping the breathing through that organ, the strongest smells will make no impression. In some animals the sense of smell is acute and powerful, beyond the conception of human beings. Thus a dog, by the acuteness of this sense, will distinguish the footsteps of his master amidst those of a hundred other people, and can thus trace him for miles, although he has been a long while out of sight. Pointers scent game at a great distance. On the other hand, this sense seems entirely denied to many of the lower animals. The sense of smell serves as a help to that of *taste*. As the tasting of unwholesome food might, in some instances, be highly dangerous, we are enabled, by smelling alone, to discover the noxious quality of substances or liquids, especially such as are putrid, and consequently peculiarly hurtful to the human frame; and at the same time that it directs us to perceive what is dangerous, it enables us to discern what is grateful and wholesome. The use of smelling, in choosing food, is more observable in brutes than in men. The cat, the dog, the horse, test every thing they eat by the nose.

2. Through the olfactory organ, the air usually passes, when the mouth is closed, in *respiration*. In sleep, however, breathing is commonly performed through both the open mouth and the nose, which produces that inharmonious sound called *snoring*. This may sometimes be occasioned, however, by hard breathing through the nose only. It has been facetiously asked, whether snoring is *vocal* or *instrumental* music. This question I do not take upon myself to decide; but as to its being *music* at all, there can be no question.

3. The nose seems to modulate the voice in *speaking* and *singing*. If it be not kept clean and clear, there are certain letters (called nasal letters,) in the alphabet, and certain syllables, which cannot properly be pronounced: for example, the letter M, which is articulated by compressing the lips, accompanied with a humming sound through the nose;—this constitutes a difference between that letter and the letter B. So with the letter N, which is also a nasal letter, the articulation of which is accompanied with a sound through the nose. Further, with regard to many of our participles in grammar, you require the nose to pronounce them properly,—as *seeing*, *hearing*, &c. In *singing* also, the nose, when clear, performs an

important function, giving full, strong, and sweeter power to the voice.

In closing this branch of our Lecture, which, if the pun may be allowed, we may call NOSOLOGY, we remark that the sense of smelling is given to us, not only to promote our animal gratification, and to direct us to a proper choice of food and drink, but at the same time to warn us against those vapours and smells which pollute the air, and render it injurious to health and life. If, therefore, you enter a close room in which there are strong smells of any kind, whether pleasant or disagreeable, take means at once to effect ventilation, so that pure, fresh, vital air may be admitted.

Those who do not accustom their nostrils to the introduction of snuff, may hope to enjoy the sense of smell, in common with other faculties, which naturally diminish by age, to a much greater extent than those who abuse them by indulgence. I again avail myself of an extract from a paper in "The Family Friend:" it is entitled "the Philosophy of a Sneeze."

"Reader—have you ever *sneezed?* Not a paltry half-stifled 't'shaw!' but an unmistakeable involuntary outburst, which it was impossible to restrain, which shook the apartment wherein it occurred, startled every body within hearing, and left you for a few seconds seemingly doubting whether your head had remained in its right place or not! Such is what I call a sneeze —and, strange though it may seem, I am about to endeavour to eke a little philosophy out of it. .... What causes a sneeze? Many things will excite sneezing,—but tobacco [in the form of snuff,] possesses, in an extraordinary degree, the power to produce this strange effect. A single grain of the dust of tobacco, applied to the healthy nostril, will excite one of those uncontrollable explosions to which I have referred.... Now the philosophy I gather herefrom is this,—that snuff is repugnant to, and impairs the sense of smell; is injurious to health; [to the power of clear enunciation in speaking and singing; gives the face a cadaverous or death-like appearance;] creates habits which are at once uncleanly and expensive; and produces an unnatural and morbid appetite, from which its victims can never obtain release."* The nose was never made to be fed, or to be a dust-hole. Young men! (I surely need not say young *women!*) abjure the *snuff-box!* Perhaps the com-

* "Family Friend," vol. 1, pp. 20, 21.

pany of snuff-takers might think the physician *pinched* them too hard, who, on being asked, whether taking snuff injured the brain, replied, "I never knew a person who had brains take snuff." We ought also to be cautious in smelling substances and liquids which cause pain. Probably the too frequent use of smelling-bottles and pungent scents is, in the end, injurious to the extremely fine and delicate lining of all the chambers connected with the nose.—Young women, abjure the *smelling-bottle!*

IV.—THE TONGUE is the organ of *Tasting*.

Under this particular we shall take occasion to notice not only the *tongue*, but also the *mouth* and the *throat*, as all these three organs are employed in eating and drinking; and these acts are connected with the sense of tasting.

1. The *Tongue* lies in the mouth; is of a long oval shape, and is chiefly composed of the fibres of the muscles, which serve for its various motions. The tongue is supported by a curious little bone in the shape of a horse-shoe, situated in the throat, by means of which it is connected with the various muscles, and attached to the adjacent parts. This bone has something to do with keeping in their proper places the parts of the mouth which are concerned in speaking, chewing, swallowing, &c. Under the tongue there is a membrane called the *frenum*, or bridle, which connects the lower surface of the tongue with the parts below. This, in some children, is found too short, preventing the free motion of the tongue; and the child is what is called *tongue-tied:* it is, therefore, necessary to cut the bridle to give the tongue liberty. The upper surface of the tongue is thickly covered with little eminences or risings, like the pile of velvet, called PAPILLÆ; which, when any sapid or tasteful substance, such as salt, alum, sugar, honey, &c., is applied to them, seem to rise up, as it were, to meet it, and form the faculty of *taste*. In exercising the sense of taste, the substance applied is mixed with the saliva, and the tongue is then pressed against the palate, the roughness of which renders the impression stronger. No other part of the mouth is endowed *originally* with the property of tasting except the tongue, as you may prove by touching your palate, or any other part of your mouth, with salt, or sugar, or alum, or cayenne pepper, when no sensation of taste will be communi-

cated, until the tongue has come in contact with the part so touched. All substances do not produce an equal impression on the organ of taste; some having a very strong savour, and others being almost insipid. It may, however, be generally remarked, that bodies soluble in water are most sapid; while insoluble substances have little or no savour. The tongue and whole cavity of the mouth are kept moist by the saliva which continually flows into them from the *salivary glands*, called PAROTID, which are placed round the cheeks. This saliva flows in greatest quantities during meals, and may even be excited by the sight of food, or fruit, or liquid, when the appetite is good: as you say your "mouth waters" when you see something delicious. Indeed, the *imagination* will produce the same effect: as, for instance, the mere thought of some savoury dish, or delicious fruit, or something acid—as the juice of a lemon—will excite an instant flow of the salivary fluid into the mouth. The saliva is of essential service in moistening the food, and preparing it for the process of digestion in the stomach. As a practical hint, therefore, I advise you not to waste it by the use of tobacco. Young men, abjure the *pipe* and the *cigar!*—to say nothing of the *quid!*

According as the different substances put into the mouth make different kinds of impressions, we have the different sensations of sour, sweet, bitter, acid, pungent, acrid, luscious, &c.

The capability of the tongue to feel a difference of tastes, was implanted, no doubt, by the all-wise Creator, that we might distinguish such food as is most salutary; for in general what is pleasant is wholesome; but that which is ill-tasted, is rarely fit for nourishment. Upon a similar principle He has invited us to take necessary food, as well by the painful sensation which we call hunger, as by the pleasure arising from the sense of taste.

The state of the stomach, as well as the general health, is often indicated by the state and colour of the tongue. In health, the tongue is always of a red colour; in disease it varies from white to yellow, and sometimes is almost black. In health, the tongue is always more or less moist; in disease, frequently parched and dry. This last condition is, however, produced in health by the mere absence of moisture, evinced by the sensation we call *thirst*.

Besides being the principal organ of taste, the tongue is the chief instrument of speech and of the articulation of the voice.

It is the tongue, in conjunction with the lips, teeth, palate, and throat, which produces the sounds of language. It is a most remarkably flexible organ. It can be elongated, contracted, and perform almost every kind of motion in the mouth. It serves to collect all the morsels which we chew; to turn them in different ways, and to different parts of the mouth; and to rub off whatever sticks to the palate. It assists in swallowing, in spitting, in sucking, &c.

Under the head of tasting, we must say a few words on

2. The *Mouth*. While the sense of tasting resides originally and chiefly in the tongue, yet it is in conjunction with the palate, the lips, and other parts of the mouth. The skin, called the mucous membrane, within the mouth is finer and more delicate than that of the rest of the body. In a general sense, the mouth consists of the lips, the gums, the insides of the cheeks, the palate, the salival glands, the TONSILS, or two glands of the throat, popularly called, from their shape, *almonds;* and the uvula. The general use of the mouth is for the reception of food, for mastication or chewing, the emission of sound, respiration, swallowing, suction, and taste. The mouth is constructed of various bones; such as the bone of the palate, and the upper and lower jaw-bones enclosing the teeth. The lips are full of blood-vessels; and hence arises their beautiful red colour when in health. They are serviceable in the general purposes of speaking, eating, drinking, and of expressing affection. The gums serve as a covering to the jaws, and contribute to the security of the teeth. The chin is the lower extremity of the face below the mouth, the promontory of the under jaws. Such is the general anatomy of the mouth,—one of the organs of taste.

3. The *Throat*, in connection with the sense of taste must be noticed, though it was previously brought before our attention, when treating of the Œsophagus, or food-pipe, and the Trachea, or wind-pipe,—passages for the food and breath. But that part of the throat which we now particularly notice is what is called the *fauces*, or the opening of a fleshy bag at the back part of the mouth called the PHARYNX, and which is shaped like a funnel, receiving the food when it is chewed, and conveying it to the œsophagus. The fauces may be plainly seen in the glass when the mouth is wide open. This part of the throat, as well as the tongue and palate, is supposed to possess, in some degree, the sense of taste.

We proceed now to the last of the five senses, and notice

V.—The HAND, the fingers of which are the principal instruments of *Touch* or *Feeling*.

This is the most general of all the senses. It exists wherever there are nerves, and they are in all parts of the body where there is life. Were it otherwise, the parts divested of it might be destroyed without our knowledge. Feeling exists in all creatures that have any sensibility. Even some plants show a susceptibility to touch; such as the sensitive plant. Many animals seem to have no sense but that of feeling; for example, the earth-worm. There are, it is true, some parts of the human body in which there is no feeling, as the bones, the cartilages, the epidermis, or outer-skin; but *feeling* may be styled in comparison with the other four, the universal sense. It is by feeling we know that a body is hard or soft, hot or cold, wet or dry, rough or smooth.

The hand, which is the chief instrument of touch, consists of the palm and the fingers, connected with the arm at the wrist. It is the part with which we hold and use any instrument. The mechanism of the hand is admirably contrived to fit it for the various uses and occasions we have for it, and the great number of arts and manufactures in which it is to be employed.

The bones of the hands and fingers have been noticed in a previous Lecture; we just observe here that each hand has no fewer than twenty-seven bones. This multiplicity of bones in the hands is essential to the various motions we have occasion to make. If each finger, for instance, were composed of only *one* bone instead of *three*, it would be impossible for us to grasp anything. The difference in the length of the fingers serves a thousand purposes, adapting them with the hand to grasp a rope, a rod, a switch, a sword; to hold a hammer, a pen or pencil, an engraving tool, a pin or needle,—in all which actions securityand freedom of motion are admirably combined. By its construction, the hand can firmly retain bodies of every form and size that are capable of being used by human strength. And because many bodies are of too great a size to be held, by one hand alone, another hand is made as an assistant to its fellow. There is not indeed a greater curiosity in the whole world than the human hand. The various actions which it enables us to perform constitute one of the principal distinctions between

man and the lower animals. So important is it, that a whole octavo volume of the "Bridgewater Treatises," (by Sir Chas. Bell), is wholly devoted to it. The human *tongue* is spoken of by an inspired writer as being "a little member," yet "boasting great things." So this small member of the frame of which we are speaking is a "little" affair, but great things depend upon it. Without it, or neglecting to use it,—how helpless should we be! "He that will not work, neither shall he eat," is a divine law; and we could not work much without the aid of this beautiful piece of mechanism, the *human hand.*

The sense of touch is most perfect at the points of the fingers. For this purpose they are furnished with a large supply of very minute blood-vessels and nerves. The sense of feeling, like all the other senses, is not equally delicate in every person; being much more exquisite in some than in others. In persons born blind, it is sometimes so exquisite, as in a considerable degree to supply the place of sight. I have read of a French lady, born blind, who had acquired a degree of touch so delicate as to be able to read a printed book merely by feeling the forms of the letters from the impression made by the types. There are, in the present day, portions of the New Testament printed with raised letters, so that blind children and adults are taught to feel them, and to read with great facility. Thus they are instructed, if I may so speak, to "*feel after* God, if haply they might find him."

There is one peculiarity in the constitution of our animal system which we should not overlook, and for which we cannot be sufficiently grateful; and that is, *the power it possesses of self-restoration.* A wound heals up of itself. A broken bone unites itself, and is made firm again; and a dead part is separated and thrown off. If all the wounds we have ever received were still open and bleeding afresh, to what a miserable condition should we be reduced! But by a system of reparative powers, beyond all human comprehension, as to the mode of their operation, such dismal results are effectually prevented.

"On reviewing the different parts of the human frame, it will be observed that most of its organs are *double.* On a line being drawn in the middle, on each side will be found parts which are exactly similar to the corresponding side. This is the case with the brain, which is a double organ, having two

series of nerves proceeding out from each side of it to go to the respective sides of the body. There are two eyes also, each reflecting a distinct image on the retina, yet the nerves communicate so that only one impression is conveyed to the sense. The ears, the nostrils, the arms, the hands, are double to suit the purposes for which they are employed; and so are the lower limbs, the legs and feet,—an essential requisite for the support of the body, and for progressive motion. We could neither stand nor walk, if we had not a *pair* of legs and feet. The lungs, too, may be said to be double, having two distinct sets of lobes; and it sometimes happens that one of them is entirely shrunk or diseased, and yet the important office of respiration is carried on. The stomach, the liver, and some of the other *viscera*, are, however, single, their several offices being common to the whole body."*

The late Dr. Hunter has observed, "that Astronomy and Anatomy are the studies which present us with the most striking view of the two most wonderful attributes of the Supreme Being. The first of these fills the mind with the idea of his immensity, in the largeness, distance, and number of the heavenly bodies; the last astonishes us with his intelligence and art, in the variety and delicacy of animal mechanism."

Dr. Young has said,

"An undevout *Astronomer* is mad:"

and we may, with equal propriety, say,

"An undevout *Anatomist* is mad."

I conclude this series of Lectures on Human Anatomy with the following summary of the parts of the body, in the words of a celebrated French philosopher:—"The *bones*, by their joints and solidity, form the foundation of this fine machine: the *ligaments* are strings which unite the parts together: the *muscles* are fleshy substances, which act as elastic springs to put them in motion: the *nerves*, which are dispersed over the whole body, connect all the parts together: the *arteries* and *veins*, like rivulets, convey life and health throughout: the *heart*, placed in the centre, is the focus where the blood collects, or the acting power by means of which it circulates and is preserved: the *lungs*, by means of another power, draw in the external air, and expel hurtful vapours: the *stomach* and

*Chambers' "Animal Physiology," p. 123.

intestines are the magazines where everything that is required for the daily supply is prepared: the *brain*, that seat of the soul, is formed in a manner suitable to the dignity of its inhabitant: the *senses*, which are the soul's ministers, warn it of all that is necessary either for its pleasure or use. Adorable Creator! with what wonderful art hast thou formed us! Though the heavens did not exist to proclaim thy glory,—though there were no created being upon earth but myself, my own body might suffice to convince me that thou art a God of unlimited power and infinite goodness."*

Again we join in the pious exclamation of one who had just finished a devout survey of the structure of the human frame; —"Marvellous are thy works, and that my soul knoweth right well! How precious are thy thoughts unto me, O God!" (or, as the words might be rendered), "How precious are thy wonderful contrivances concerning me, O God! how great is the sum of them! If I should count them they are more in number than the sand." "I will praise thee, O Lord; for I am fearfully and wonderfully made!"

"Heaven, earth, and sea, and fire, and wind,
Show me thy wondrous skill;
But I review myself, and find,
Diviner wonders still."

* Bonnet's "Contemplation of Nature," vol. i., p. 64.

THE END.

G. AND F. KING, PRINTERS, FLEET STREET, COVENTRY.